The Electrical Industry's Weekly Magazine October 6, 1958

Electrical World

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Electrical World presents five special reports on "Modernizing Electric Power Systems"

PLAN '59

Modernize now for growth and profits

A SPECIAL REPORT FROM McGRAW-HILL TO AMERICA'S BUSINESS EXECUTIVES

1 **Modernize GENERATION to cut power costs**
..page 71

2 **Modernize TRANSMISSION to boost capacity**
Coming Oct. 13

3 **Modernize DISTRIBUTION to improve service, cut cost**
Coming Oct. 20

4 **Modernize SERVICE FUNCTIONS to meet future growth**
Coming Oct. 27

5 **Modernize INDUSTRIAL PLANTS and STREET LIGHTING to enhance community growth**
Coming Nov. 3

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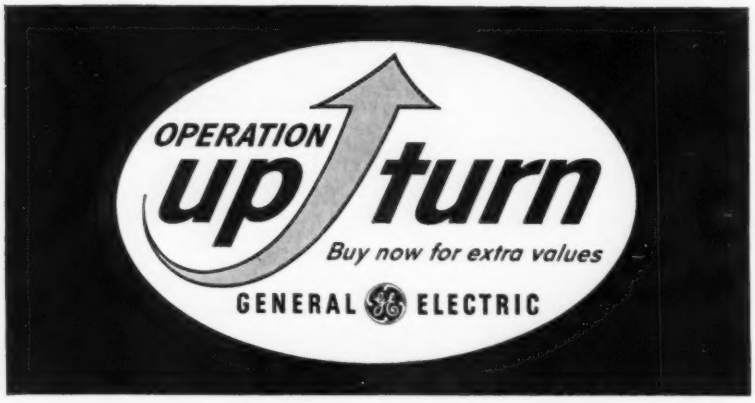
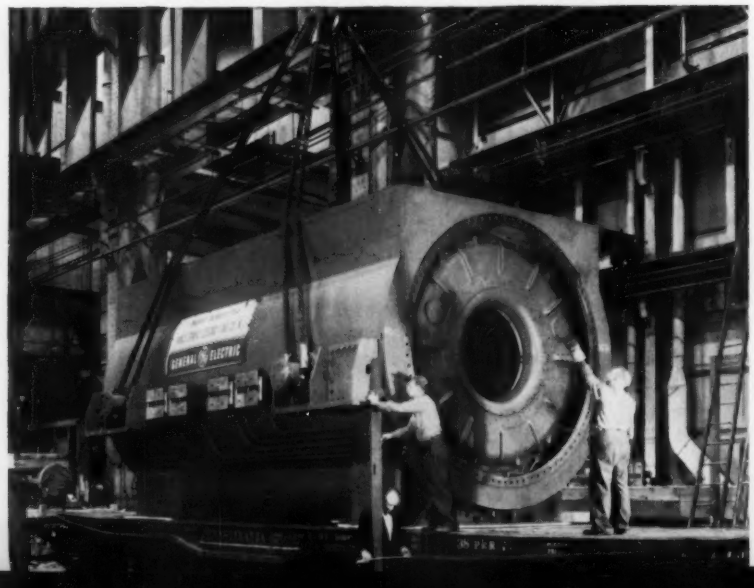
How OPERATION UPTURN can benefit electric utilities



OPERATION UPTURN BUILDS LOAD

OPERATION UPTURN OFFERS OUTSTANDING VALUES



As a dramatic demonstration of its confidence in the nation's economic strength, General Electric recently announced OPERATION UPTURN—a Company-wide program designed to help speed the upturn in business. This program marshalls all of G.E.'s management and technical skills and brings them to bear on the challenging task of encouraging customers to buy NOW for extra values. In addition to utilizing new business strategy and aggressive marketing techniques, Operation Upturn enlists the support of 221,000 employees, 385,000 share owners and hundreds of thousands of natural sales allies—dealers, distributors, suppliers.

BUILDING SALES AND JOBS—Operation Upturn is one common-sense answer to current business problems. It further stimulates an economic chain reaction (1) to help revitalize employment and the business climate; and (2) to encourage industry to get on with long-range plans tied to needs of growth years ahead.

BENEFITS TO ELECTRIC UTILITIES ARE TWOFOLD

- **Building load**—By encouraging consumers and industries to purchase electrical goods now, Operation Upturn helps build new loads for electric utilities, thus making possible immediate power sales for utilities to offset declines in other power consumption categories.

- **Outstanding values**—Operation Upturn re-emphasizes the outstanding extra values and up-to-date products General Electric offers utility companies today. With prosperity linked directly to inevitable population increases, electric utilities can gain important advantages by carrying forward . . . NOW . . . their long-term construction programs on a steady basis at today's favorable prices.

FOR MORE INFORMATION about Operation Upturn, and what it offers in terms of your business and long-range plans, contact your nearest G-E Apparatus Sales Office. General Electric Company, Section 301-390, Schenectady 5, New York.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 150, No. 14 OCTOBER 6, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

CURRENT EVENTS

FPC Defends Its Licensing Practices

In hearing before Harris committee on oversight, staff explains view on extension of 50-yr hydro licenses.....p 65

MANAGEMENT NEWSLETTER

Net Incomes of 144 Utilities Up 7.2%

EW's study also shows 24 companies have lower net income for 12 months ended June 30 than previous year.....p 135

Special Report

Modernize Generation to Cut Costs

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How Modern Is American Industry?

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The "Why" of Plant Retirements

Replacing older units with newer, more efficient equipment has been decided factor in recent retirements.....p 76

How to Improve Older Plants

Results of a survey of 130 design details of 71 new thermal units give ideas for modernizing.....p 79

How Some Companies Modernized

Opportunities in power plants are many, but most modernization accomplishments center around station control.....p 84

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WHEN you consider expansion . . .
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the creative ability of men.

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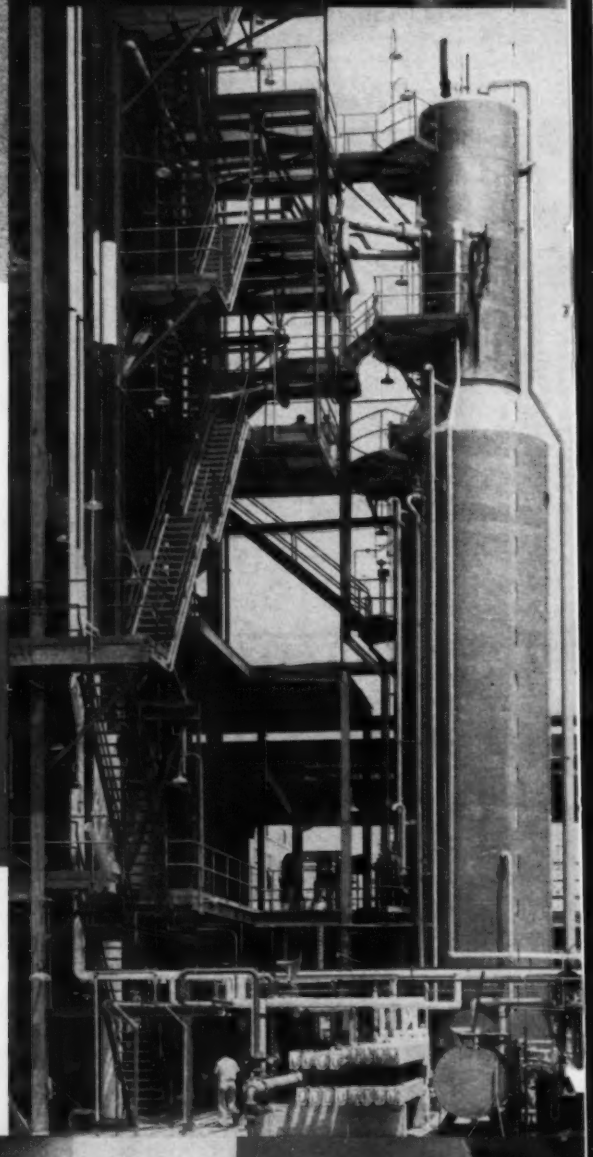

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Completed 40 days ahead of schedule this new 60,000 KW steam electric unit at San Bernardino is producing profits for California Electric Power Company.

World Coverage of Electrical World

Next week's top news story may break in Dallas or Washington, Moscow or Melbourne. We don't know what the story may be, but wherever it happens on the face of the earth we are pretty sure of having a trained correspondent within a few hours flying time from the spot.

A few weeks ago in Moscow a delegation of top U. S. power executives was interviewed by McGraw-Hill Correspondent William Coughlin. A wirephoto of this group was the first transmitted by our recently opened Moscow Bureau.

A day or two later this same delegation met with McGraw-Hill Correspondent Victor Lusinchi who had been assigned to follow up the Moscow story.

As far as we know the Electrical World stories were the only on-the-spot coverage given in an industry publication.

Last week's issue carried full engineering coverage of the Geneva atoms-for-peace conference. The story was furnished by our own special correspondent, J. H. M. Sykes, editor of a British technical journal.

The same issue also carried highlights of the World Power Conference held in Montreal. The report was prepared by Managing Technical Editor Leonard Olmsted.

To bring you the latest information to serve you in your daily job, Electrical World editors and correspondents must cover electrical operations and interview industry men wherever they may be.

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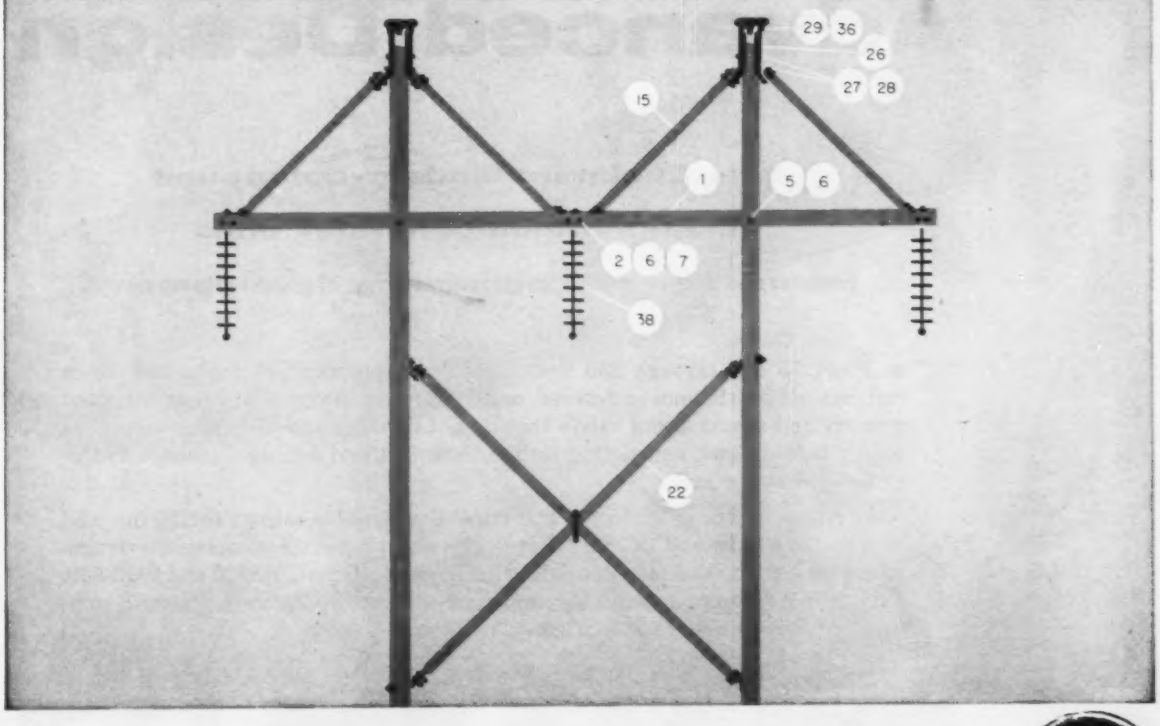
H-FRAME STRUCTURE, DOUBLE PLANK CROSSARMS WITH METAL SPACERS, POLE TOP STATIC WIRE SUPPORTS, AND WOOD CROSS BRACES DESIGNED FOR 69 TO 154 KV CONSTRUCTION

DRG. REF. #	QUANTITY	DESCRIPTION	DRG. REF. #	QUANTITY	DESCRIPTION
792	2	Pole	15	4	Vee brace 3⅜" x 4⅜" cross section
1	2	Crossarm	22	1 set	Cross brace w/fittings, clamp, ⅞" pole bolts and curved washers
2	3	Steel spacer fitting w/mounting bolts	26	2	Static wire support
5	2	Stud bolt ⅞" w/washer nuts	27	4	Machine bolt ¾"
6	8	MF locknut ⅞"	28	4	MF locknut ¾"
7	1	Bent stud bolt ⅞" x 8" w/2 sq. nuts	29	2	Clevis
			36	2	Suspension clamp for static wire
7	2	Bent bolt ⅞" x 5½" w/sq. nut	38	As required	Suspension insulators and fittings



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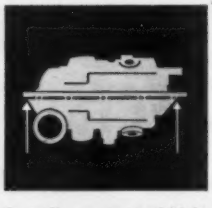
Advanced Design

Allis-Chalmers tandem-compound steam turbine-generator units feature newest engineering developments

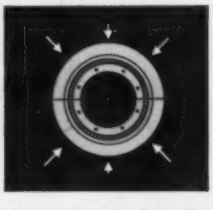
● From 75 mw through 250 mw, these 3600-rpm tandem-compound steam turbines utilize the most advanced design features, such as side-crossunders and primary and reheat steam valves that do not require removal during inspection, solidly bolted down non-sliding turbine pedestals, and flexibly supported hydrogen-cooled stator core.

Advances in design of double and triple-flow tandem ratings to 250 mw and of 3600/3600-rpm and 3600/1800-rpm close-coupled cross-compound arrangements to 300 mw and larger are revealed in publications 03R8620 and 03R8880. Call your A-C representative for copies, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

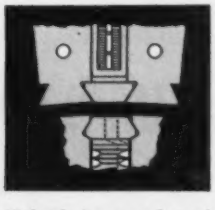


Centerline support of high-temperature turbine provides sustained concentricity of cylinder with spindle — offset parting joint adds rigidity to casing lower half without affecting the overall cylinder symmetry.

Side-mounted, underslung turning gear, for units with 23-inch exhaust blades and larger, engages shaft ring-gear below centerline — it need not be removed or electrically disconnected for unit servicing.



Ring-type nozzle chests, for 1000-1050-F inlet temperatures, are supported and keyed in inner casing, can expand freely, following spindle radial expansion. They also provide optimum nozzle orientation.



High-velocity supercharged hydrogen-cooling is employed in generator rotors for all 3600-rpm units over 50 mw—also in stators and their terminal conductors and bushings for units rated 150 mw and above.

A-C ALLIS-CHALMERS

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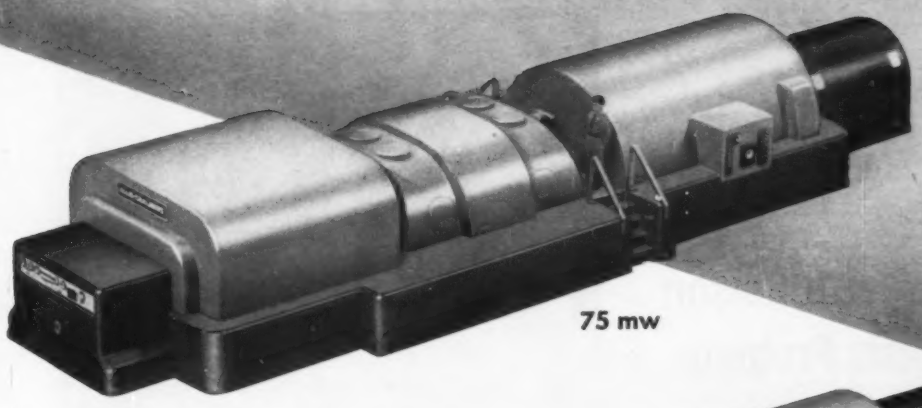
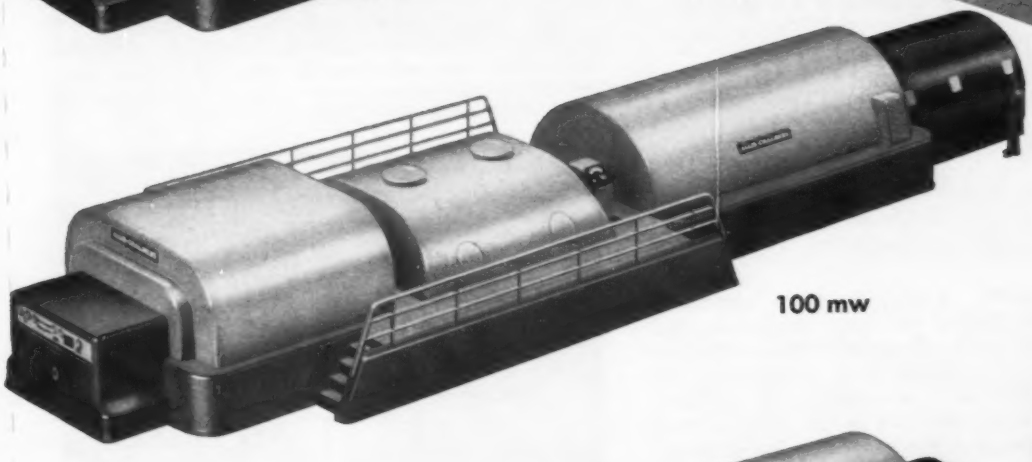
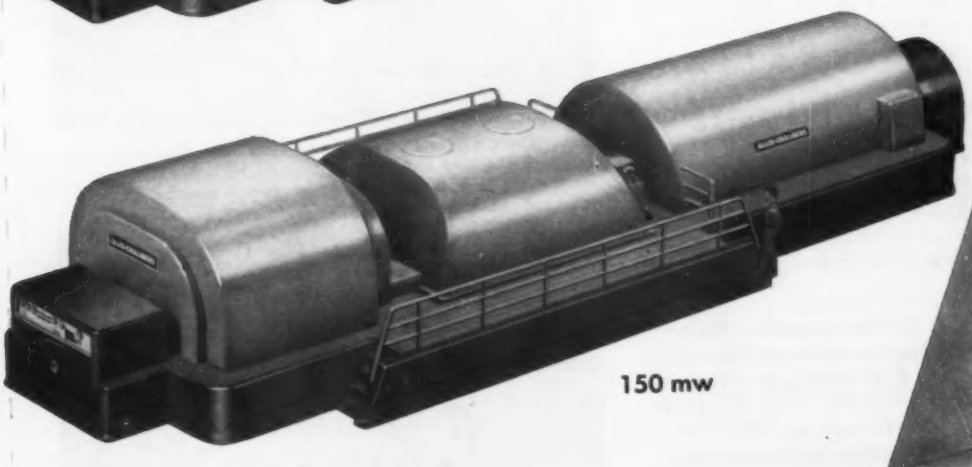
A-5695



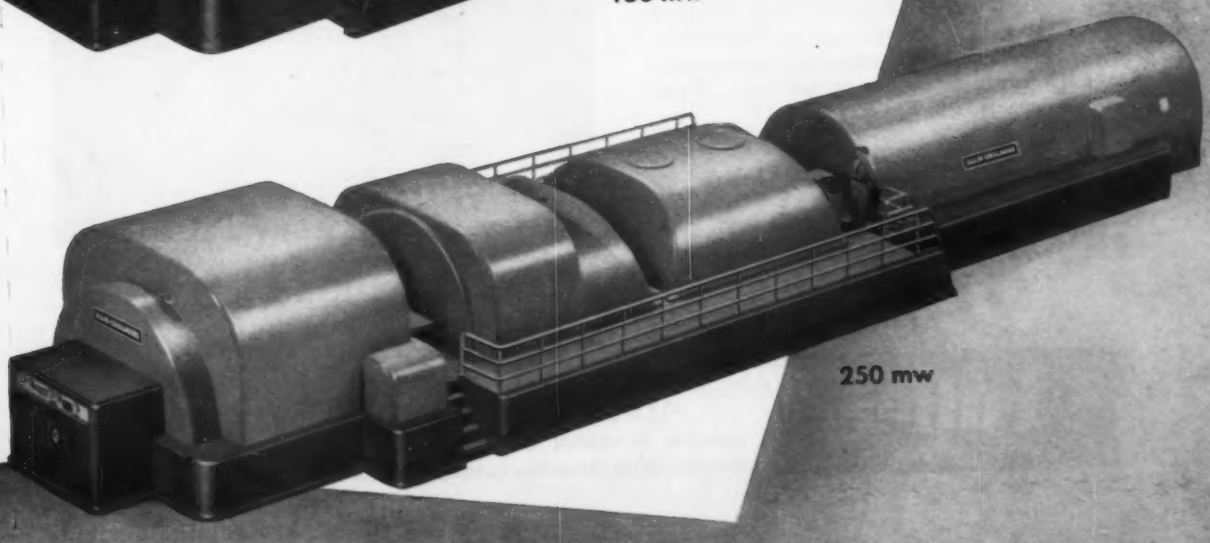
75 mw



100 mw



150 mw



250 mw

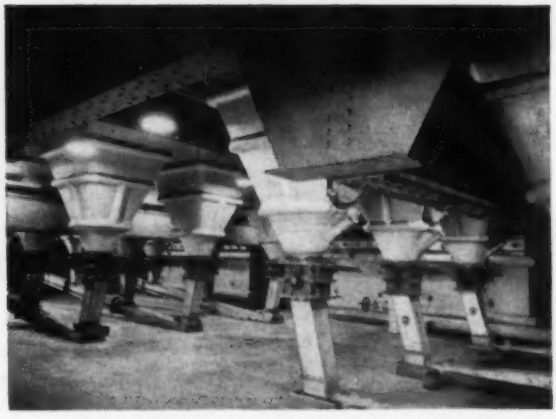
How Commonwealth Edison Turned a Fly Ash Problem Into Profit

At Commonwealth Edison's State Line Station, about 350 tons of fly ash a day had to be wet down, loaded, and trucked to suitable dumping sites.

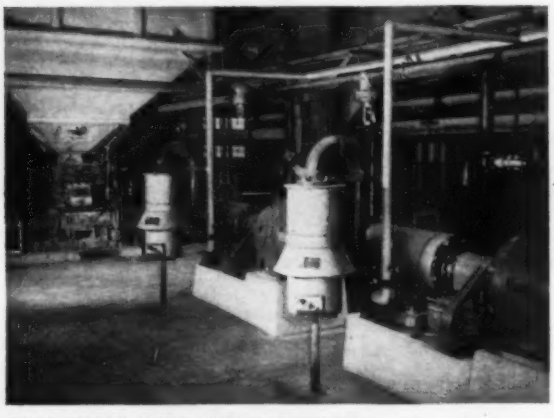
Waste becomes profit. Today, the plant burning a peak load of 5000 tons of coal daily collects dry fly ash automatically in a totally enclosed Fuller-Kinyon system. The ash is conveyed from precipitators to storage bins and silos, where it's sold as a by-product. Manpower: just three men, one at the main control panel and two bagging the ash for sales to local contractors.

Air and gravity do the work. F-H Airslide® conveyors fluidize dry fly ash by a column of low-pressure air for easy movement by gravity to central surge hoppers. Then, a Fuller-Kinyon pump under each hopper drives the ash by air through a five-inch line to storage. The system is practically maintenance-free. There are few moving parts to foul or wear out.

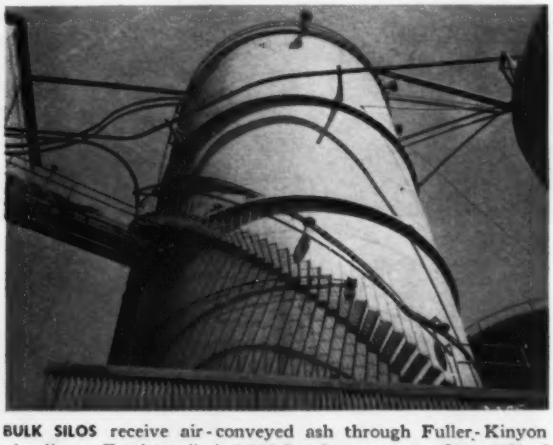
Large and small plants can get the benefits of Fuller-Kinyon fly ash handling. Capacities range from 100 to 8,000 cubic feet an hour. F-H Airslide and Fuller-Kinyon conveying lines can be curved to avoid beams and other obstacles. Low-pressure air provides power inexpensively and installation costs are significantly less than other types of conveying systems. Write for detailed information in Bulletin FF-49-1.



F-H AIRSLIDE FLUIDIZING CONVEYORS ANGLE DOWNWARD from precipitator hoppers, move air-activated ash to 20-ton central surge hoppers under floor. There are few moving parts.



FULLER-KINYON PUMPS AND COMPRESSORS under surge hoppers propel ash to bins and silos at 20 tons an hour. Fluidized by air, the abrasive, 300°F. ash moves without injuring system.



BULK SILOS receive air-conveyed ash through Fuller-Kinyon pipe-lines. Farthest silo is 1,000 feet from pumps. Over 50% of fly ash is bagged and sold as a by-product.

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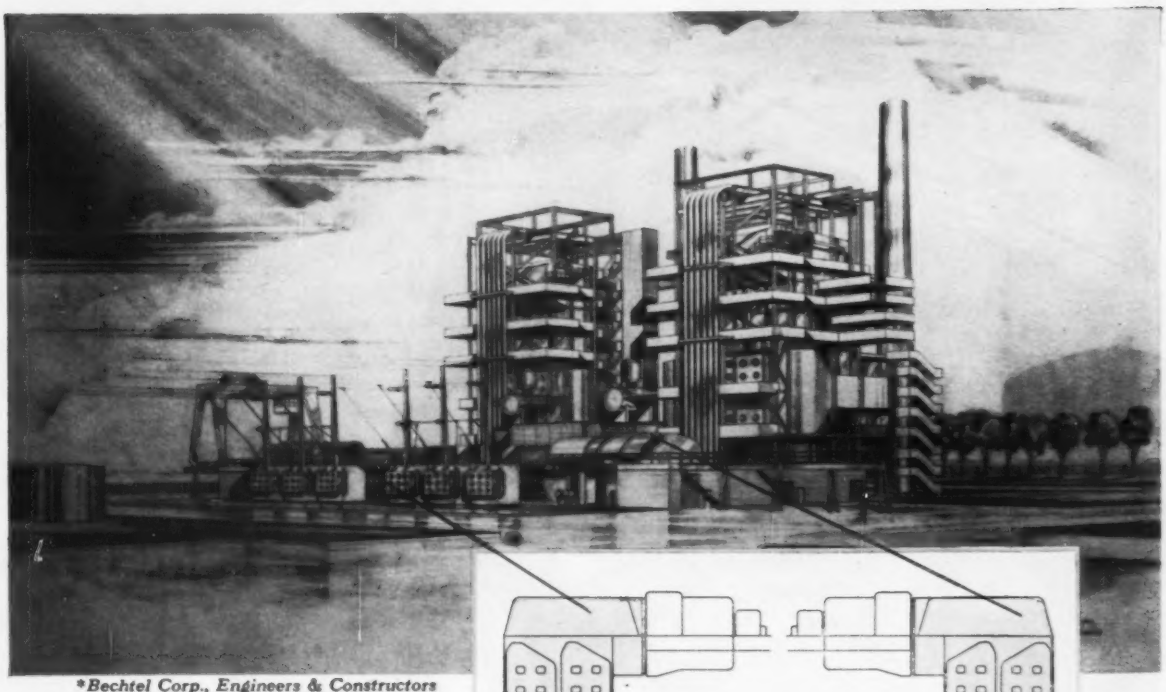
For Southern California Edison Company's new Huntington Beach Steam Station*...



*Bechtel Corp., Engineers & Constructors

Ingersoll-Rand

axial-inlet condensers

will serve each 200 MW unit

Designed for an eventual four units, the first two units of the new Huntington Beach Steam Station are now under construction. Turbines are cross-compound axial exhaust, 2400 psig., 1050°/1000°, 3600/1800 rpm. As indicated above in the artist's rendering, these units will be served by axial-inlet condensers, specially designed for this installation by Ingersoll-Rand. These I-R condensers are 2-pass units, each with 110,000 sq ft of surface.

In addition to the surface condensers, Ingersoll-Rand is furnishing the following associated equipment:

- **5 boiler-feed pumps** rated 2020 gpm at 6400 ft TDH.
- **4 vertical condensate pumps,** 3-stage, rated 2500 gpm at 350 ft TDH.
- **5 condensate booster pumps,** rated 1851 gpm at 1970 ft TDH.
- **4 vertical condenser circulating pumps,** rated 44,000 gpm at 35 ft TDH. The columns and discharge head sections are lined with Fiberglas.
- **2 steam-jet ejector units,** 2-stage, single-element with surface-type inter and after condensers.
- **2 horizontal reciprocating vacuum pumps** each driven by a 100 hp electric motor.

This installation is another dramatic example of Ingersoll-Rand's ability to meet the requirements of the modern steam plant... with advanced design surface condensers, pumps and associated equipment. Your I-R engineer will be glad to help you determine the equipment best suited to *your* requirements.

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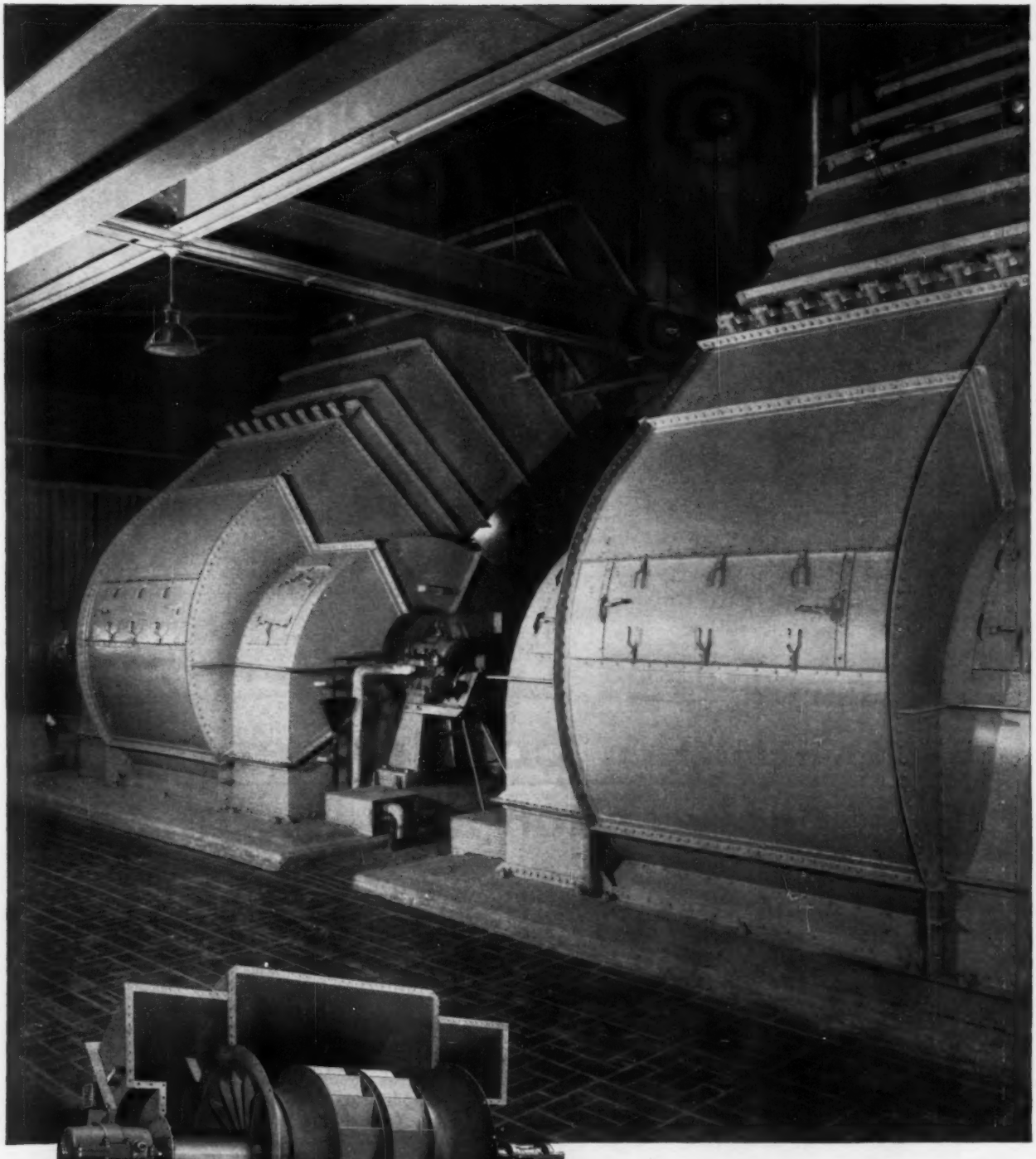

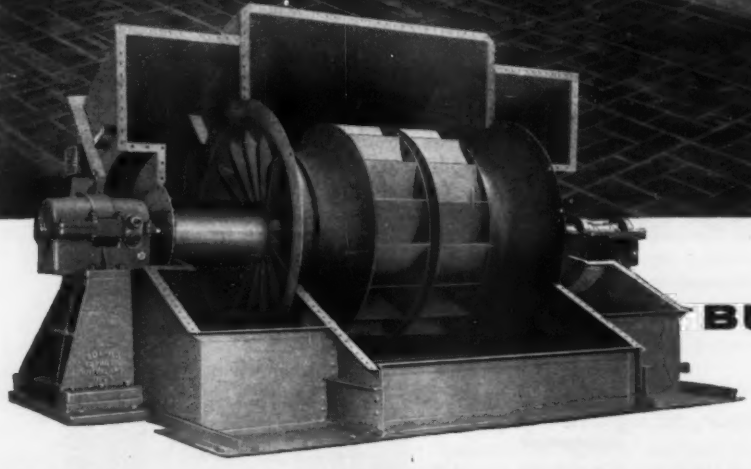

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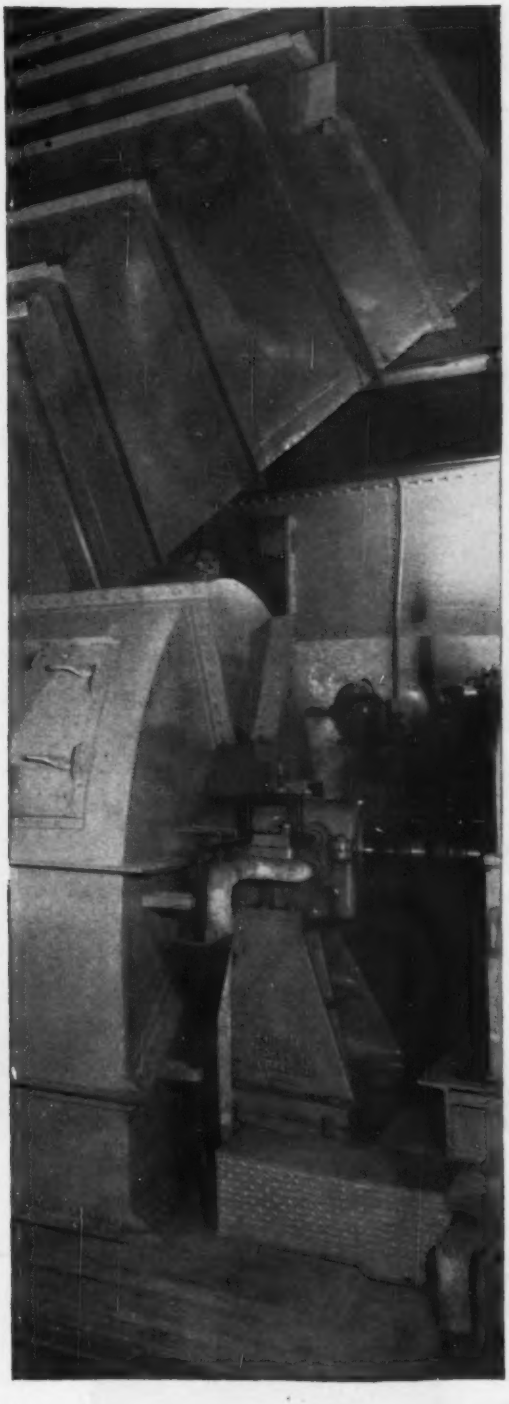

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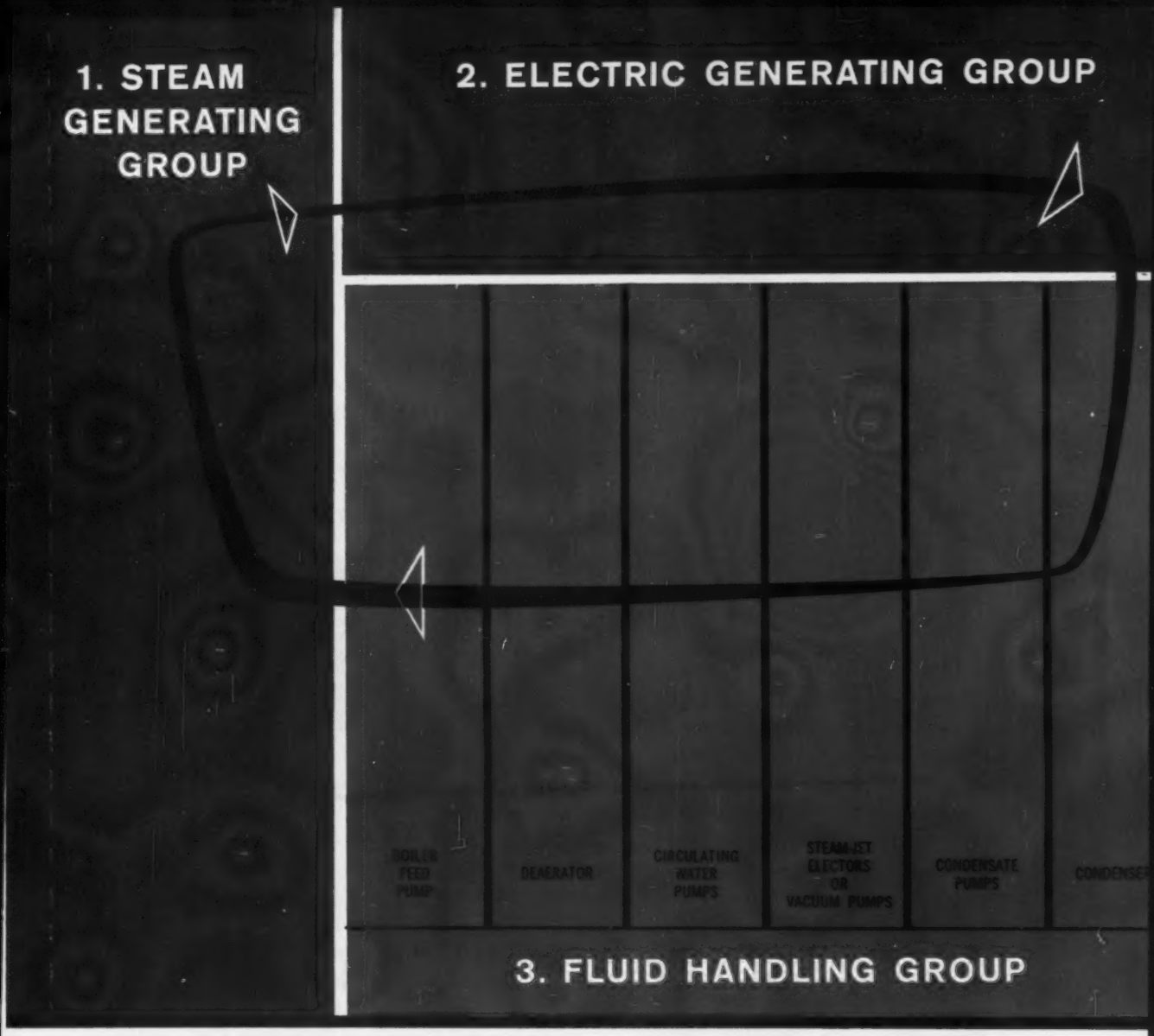


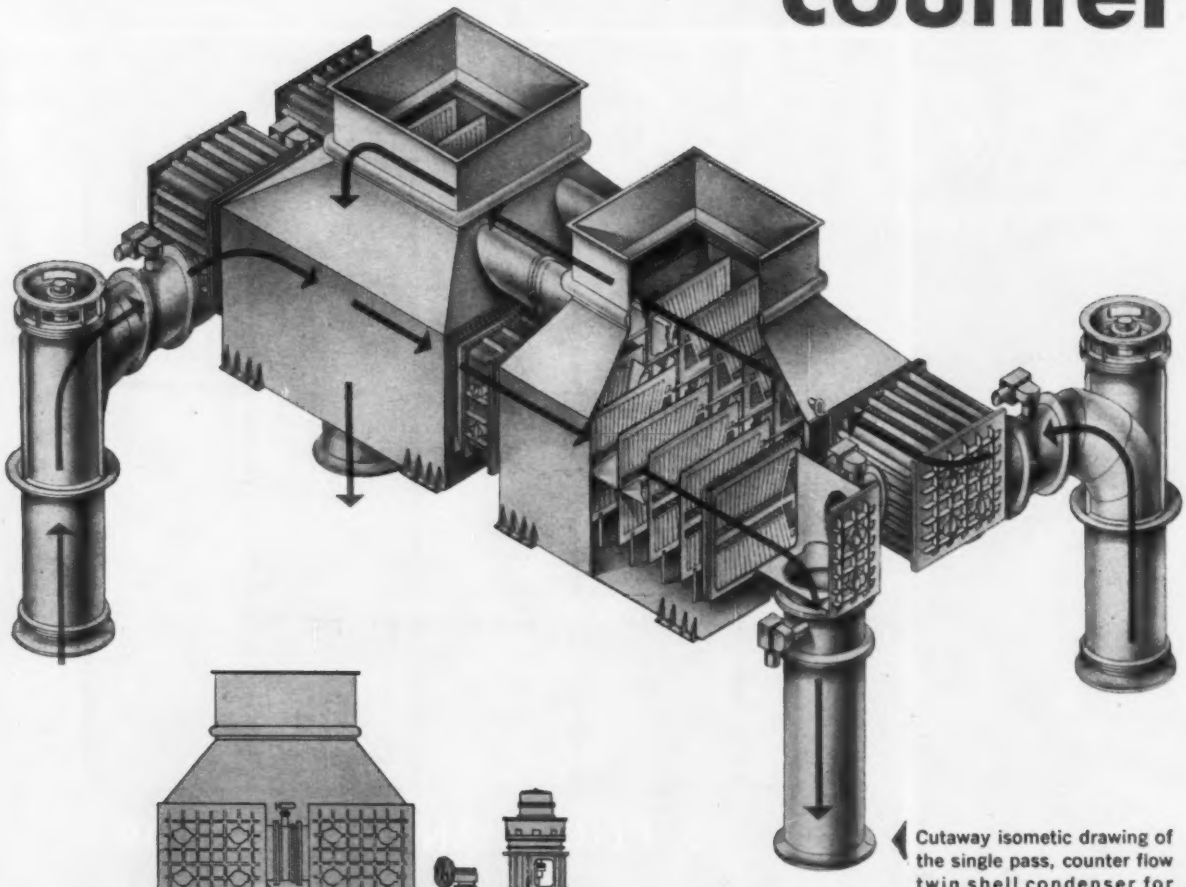
LOOK AT ALL THREE FOR POWER

THE FLUID HANDLING GROUP in a steam power plant has as many individual components as the other two combined. Failure of any one component can disrupt operation of the whole. Reliability can best be achieved through compatible integration of the wide range of equipment in this all-important group. As a manufacturer of all major fluid handling components, Worthington's "system-wise" experience and knowledge can be of extreme value to you. For information, write or call your nearest Worthington district office. Worthington Corporation, Harrison, New Jersey.

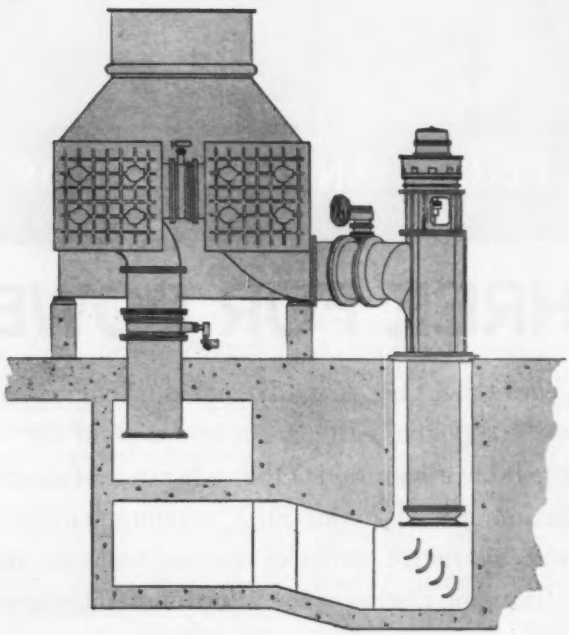
45-1

WORTHINGTON

New FW single pass, counter



Cutaway isometic drawing of the single pass, counter flow twin shell condenser for Barry Steam Plant, showing water flow during normal full load operation.



General cross section at pump intake. Foster Wheeler also supplied the two vertical, mixed flow circulating pumps, each designed for 80,000 gpm at 20 ft TDH; and the three horizontal, 5-stage double suction condensate pumps, each rated 1500 gpm at 565 ft TDH.

FOSTER

NEW YORK • LONDON • PARIS

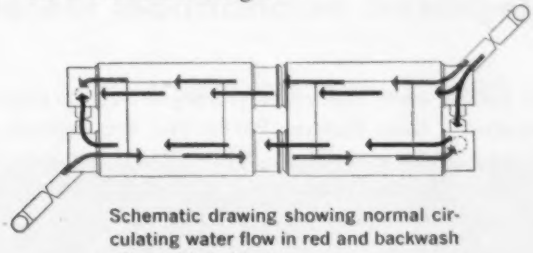
flow condenser

offers these important advantages for Alabama Power Company's Barry Steam Plant

- **LOW COST**
- **BALANCED BACK PRESSURE**
- **SIMPLIFIED BACKWASHING**
- **FLEXIBILITY OF OPERATION**

THE NEW Foster Wheeler single pass, counter flow condenser was specifically designed to meet the unusual conditions imposed by Alabama Power Company and Southern Services, Inc., Engineers, in laying out a plant extension for Alabama's Barry Steam Plant, Unit No. 3.

By the application of the established principles of Foster Wheeler condenser design, a most economical arrangement for a twin bottom-exhaust turbo-generator set with tubes at right angles to the turbine shafts was provided. It features short tube lengths, complete back washing and a minimum number of waterboxes for a twin-shell design.



Schematic drawing showing normal circulating water flow in red and backwash of one side in black.

Backwashing of the tubes and tube sheets is obtained with only six valves, two of which are the normal circulating pump shut-off valves. This valving arrangement also allows the complete condenser to be operated at light loads with only one circulating pump.

Serving the 225,000 kw turbine for Unit No. 3, the Barry Steam Plant condenser has 150,000 sq ft of tube surface, with 23,876 1-inch tubes having an effective length of 24 ft. It is designed to maintain 1.92" Hg back pressure when condensing 1,100,000 pounds of steam per hour with 160,000 gpm of 80F cooling water.

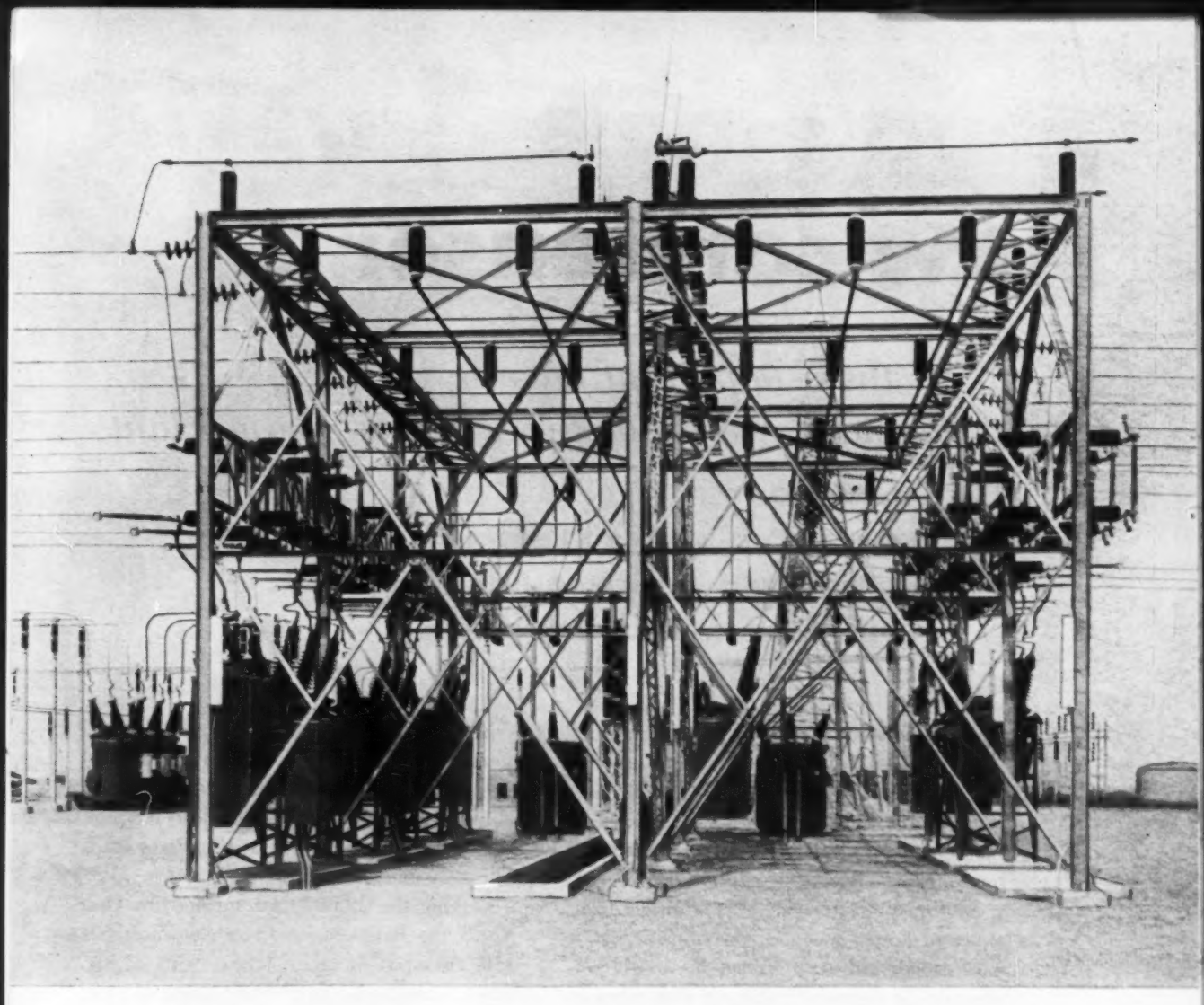
Foster Wheeler is continually working toward the improvement of condenser designs for higher efficiencies and greater economies of installation and operation, such as described above. We would welcome the opportunity to be of service to you.

For further details on this installation, send for the July 1958 issue of Heat Engineering. *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, New York.*

WHEELER

ST. CATHARINES, ONT.

STEAM GENERATORS • SURFACE CONDENSERS
FEEDWATER HEATERS • COOLING TOWERS
ECONOMIZERS • COAL PULVERIZERS



SINGLE-SOURCE SUBSTATION PACKAGE

assures totally-integrated, economical installations

Speeding installation...saving you time and trouble...assuring top quality construction throughout – Federal Pacific stands ready to meet *all* your switchgear requirements in a single operation. The advantage: one order, one equipment manufacturer, unified control.

From initial engineering service to the completed installation–one plan guides the entire project to simplify purchasing, provide more accurate cost control and eliminate unexpected "hidden costs". And more important, when you buy the complete package from Federal Pacific you are assured a completely integrated installation. Each component is engineered to insure trouble-free, smoothly integrated operation.

With more than 50 years of experience in this field...with installations throughout the world...with a steady flow of repeat orders indicating satisfied acceptance–Federal Pacific is equipped to meet all your switchgear needs from beginning to end. Federal Pacific Electric Co., 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

The Electrical Week

FUTURE NEWS ▶ **Watch for a major change in Electric Companies Advertising Program campaign for 1959.** Plans were discussed this week . . . Meanwhile IRS plans another closed staff conference after Nov. 1 to hear power companies' arguments against its ruling on ECAP ads.

AEC may not get a solid proposal from either private or public power to build a gas-cooled, graphite-moderated reactor. November deadline is probably too early for companies; public agencies don't have the money, and Congress is not likely to provide it.

LATE NEWS ▶ **Alabama Power and IBEW agree to 5% wage hike across the board,** retroactive to Aug. 15. Issue of whether or not to take load dispatchers out of bargaining unit goes to NLRB for decision.

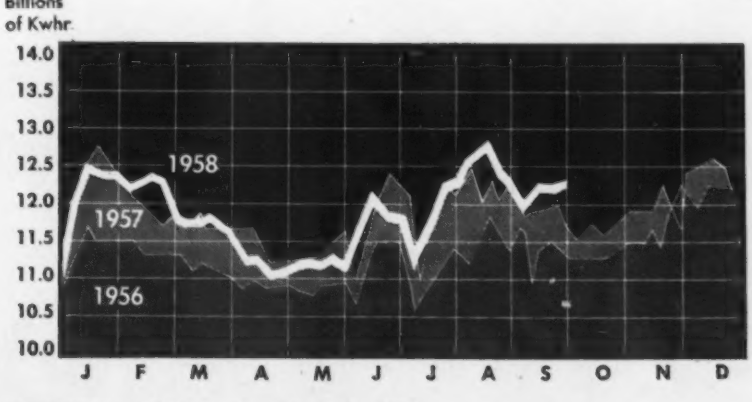
Central Maine Power asks PUC for 7½% rate hike . . . First concrete is poured for Yankee Atomic plant . . . Coal is on the way downriver to fire first 250,000-kw unit in City of Memphis' steam plant, expected to begin power production in November.

Development of first mobile vibration lab that can get data from energized h-v lines has been completed by a joint utility-manufacturer team . . . GE announces reductions in guaranteed transformer losses averaging 10% on units 750 kw and up, with no increase in price . . . RT&E will unveil this week a transformer specifically designed for underground distribution . . . Hubbard & Co acquires Electrical Engineers Equipment Co . . . Babcock & Wilcox Co's new pool-type research reactor achieves criticality.

Virginia E&P gets bronze "Oscar of Industry" for best annual report of the largest electric utilities. Presentation: Oct. 27 in N. Y.

Management changes . . . Federal Pacific Electric ups Thomas M. Cole to president; Joseph S. Thompson becomes honorary chairman.

POWER OUTPUT—UP 5.5% (Week ending Sept. 27), Kwhr 12,342,000,000



Per Cent Change From Previous Year

	Sept. 13	Sept. 20	Sept. 27
Total U. S.	+2.5	+2.1	+5.5
New Eng.	+2.4	+2.7	+5.1
Mid. Atlantic..	−1.8	−0.8	+3.5
Cent. Ind	+2.2	+2.0	+4.9
West Cent. ...	+7.7	+4.4	+8.2
Southeast	+1.0	+2.1	+4.2
South Cent. ...	+14.4	+4.3	+19.6
Rocky Mount..	+9.0	+5.6	+6.2
Pacific			
NW	−4.1	−3.2	+0.9
SW	+1.2	+5.6	+1.7

Seasonally Adjusted Index 238.9

Week Ago 235.3 Year Ago 225.8

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Can FPC grant new licenses to existing dams previously unlicensed?** Pro's and con's were aired Sept. 25 in a hearing before the House Legislative Oversight Subcommittee. FPC Chairman Jerome Kuykendall claims the issuance of a new license is both legal and desirable, if a "major new project" is included in the license. Public power advocates claim the practice violates the Federal Power Act. An analysis of the issues of the hearing appears on p 64.

Sen John F. Kennedy voiced his support for REA in a Region I meeting of the National Rural Electrification Cooperative Assn Sept. 26 at Burlington, Vt. The Massachusetts Democrat pledged to "strengthen the REA program and protect it against weakening attacks" (p 65).

Five Rocky Mountain utilities plan coordinated growth, slate interconnection of their systems in an ambitious $2.5 billion expansion program. It aims to hike the companies' generating capacity from 2.5-million kw to 9.5-million kw by 1975 (p 67).

Costa Rica's President Mario Echandi springs a surprise by promising the people that he will take steps to nationalize American & Foreign Power's installations in that country. According to A&FP officials, the company has a signed agreement extending until 1966 to supply power on the basis of a 10% return on the investment (p 70).

Normalize taxes for rate purposes, California utilities and transportation companies told the state PUC in hearings late last month, or effects of liberalized tax laws will be nullified (p 69).

Six hundred delegates heard a call to action at the 51st annual convention of the Pennsylvania Electric Assn in Pittsburgh last month, as the task of maintaining customer support was called "the major task confronting utilities today" (p 68).

SPECIAL REPORT: MODERNIZATION OF GENERATION ▶ **Modernize generation to cut power costs.** That's the subject of the first of five special reports prepared by Electrical World as part of McGraw-Hill's "Plan '59"—urging the nation's industries to modernize now for growth and profits. Subsequent issues will include special reports on modernization of transmission, distribution, service, industrial plants, and street lighting. In this issue, the accent is on generating facilities. Here are four articles:

How modern is American industry? Not as modern as you may think. In spite of the capacity boom of recent years, less than one-third of all business plant and equipment is "new" since 1950; two-thirds is pre-Korea. McGraw-Hill's Dept of Economics finds that it would cost $95 billion to replace today's obsolete equipment. And $12 billion would be spent on electric and gas utilities (p 72).

Why is generating equipment retired? Replacement of older units with newer, more efficient equipment has recently accounted for an increasing proportion of retirements. Diesel equipment, with its rela-

tively higher operating costs, is being retired earlier than hydro or steam equipment. And trends indicate that age may no longer be the big factor in retirement plans of the future (p 76).

How can you improve older plants? Here is a summary of the latest design features of 71 modern steam-electric generating units. Based on EW's Fifth Steam Station Design Survey, it offers some fruitful suggestions for plant modernization (p 79).

How are utilities modernizing now? Here are some concrete examples of how some utilities have already modernized their generating plants. Examples include centralized control, coal and ash handling, water treatment, and turbine-generator units (p 84).

MANAGEMENT ▶ **Recession was no bar to electric utility earnings,** as net incomes of 144 companies rose by an average of 7.2% in the twelve months ended June 30. Even in the hardest-hit industrial centers, most utilities made gains. For details and a tabulation of EW's 144-company sample, turn to p 135.

SELLING ▶ **The Havana Hilton is living better electrically** with 642.4 kw of electric cooking equipment recently installed in its kitchens. Big winners are the chefs, who laud its precise temperature control and "clean, comfortable atmosphere" (p 124).

MANUFACTURERS ▶ **A 250,000-kva breaker goes on the road** for a year-long nation-wide tour. It is being sent by Federal Pacific Electric in a special trailer behind a station wagon . . . S & C Electric is now using a distribution equipment demonstrator that carries its own collapsible pole . . . Asplundh Tree Expert Co has a new design in hydraulic lifts for line work and tree trimming (p 100).

NEW EQUIPMENT ▶ **Packaged substations come in 160 models** rated from 45 to 3,000 kva . . . Capacitor mount in pre-wired, 12-unit equipment handles up to 600 kvar . . . Combination body can be used for light line work, maintenance, general service (p 110). See Reader Service on p 120.

PEOPLE ▶ **D. R. McClung becomes president of Pacific P&L,** succeeding Paul B. McKee who becomes chairman of the board and chief executive. George Mackenzie becomes vice president and comptroller. D. C. Frisbee is new treasurer and assistant secretary . . . Georgia Power elects H. P. Whitehead vp (p 143) . . . Wheeler Reflector Co appoints Winthrop W. Sargent as general manager (p 146).

NEXT ISSUE ▶ **Modernize transmission to boost capacity** will be the theme of next week's special report on modernization. The report will evaluate adequacy of our present systems, examine the means available to modernize them, and show the extent to which they are being used.

Many essential farm operations can be continued during a power interruption by belting a tractor or truck engine to the water pump and ventilating fan. And a hose tapped to its intake manifold can provide the vacuum for a milking machine. — **H. M. Jalonack, Transmission and Distribution, August, 1958.**

TECHNICAL NOTES

Unalloyed uranium metal nuclear fuel rods lose their shape badly under nuclear bombardment and even under repeated temperature cycles. In some cases rods of uranium more than double their length after a burnup of only one atom in a thousand.

A temperature of 500 million degrees would be needed to achieve a nuclear fusion reaction with deuterium (heavy hydrogen); the corresponding temperature for a deuterium-tritium (super heavy hydrogen) mixture would be 150 million degrees.

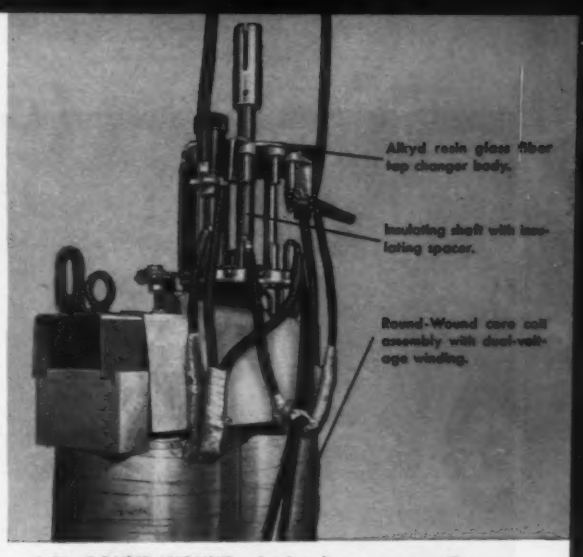
Dc transmission may offer economical solution to some problems that are difficult for ac. It can tie large systems together without affecting materially the interrupting duties on their switchgear or upsetting their voltage regulation. Systems tied with dc transmission need not be in synchronism nor even of the same frequency.

Increasing hydro storage capacity by raising the dam height can be more economically accomplished by providing ducts for future installation of stress cables, according to estimates made for the construction of the Avon Dam in England. The conventional method of providing an additional width of foundation at the time of construction, followed by thickening of the dam at the time of raising, would cost twice as much.

FROM EDITORS IN THE FIELD

Interest in digital computers for system load flow and fault studies increases, but faith is being expressed in the continued utility of the network analyzer. U. S. Bureau of Reclamation has upped analyzer capacity two-thirds by adding six automatically regulated generators, 32 auto-regulated load units, associated line and transformer units, and a step-by-step swing curve calculator.

COVER-MOUNTED series-multiple switch control for L-M dual-voltage transformers. The aluminum cap is simply unscrewed by hand and turned over to operate the switch. The oilproof and weatherproof seal is completely independent of the cap. Voltage is clearly indicated under the cap. (Arrow)


Alkyd resin glass fiber tap changer body.
Insulating shaft with insulating spacer.
Round-Wound core coil assembly with dual-voltage winding.

L-M ROUND-WOUND dual-voltage core-coil assembly, showing the direct motion-transmission from the cover-mounted control through self-aligning stainless-steel shaft. The heavy-duty snap switch is built with the same time-proved components used in the trouble-free L-M tap changer.

L-M's Dual-Voltage Transformers Offer Cover-Mounted Switch, Round-Wound® Design

Cover-mounting provides direct control, better rigidity, with less danger of oil leakage and accidental damage. Round-Wound construction assures best possible performance.

By DENNIS A. MANNING
Manager, Transformer Sales & Service
Line Material Industries

L-M dual-voltage transformers offer some appreciable advantages to companies in the process of changing over to higher distribution voltages. When the change is definitely planned, L-M dual-voltage Round-Wounds make it possible to change the transformer from a lower voltage to a higher one simply by unscrewing the cap at the top and snapping the switch.

This reduces labor in cutting over; there is less down time, resulting in increased revenue to the utility and better service to the customer—certainly important advantages.

Some Disadvantages

In considering the installation of dual-voltage transformers, some disadvantages should be recognized. First, the cost of the units is higher than the cost of a standard transformer. Second, losses are at least those of the higher-voltage winding. If the transformer is to be operated at the lower voltage for a long time, these higher losses may be a factor worth considering.

However, where the change is contemplated within a reasonable length of time, reduced labor costs and elimination of down time may well be offsetting factors.

Many Advantages of Cover-Mounting

The cover-mounted L-M switch is an excellent feature. Vertical construction makes for excellent mechanical design. Motion is transmitted directly to the switch by a self-aligning shaft. This shaft is stainless steel, which prevents corrosion that could cause binding.

With the switch control in the cover, there is less danger of tampering, less danger of accidental damage, and less interference when mounting the transformer. The switch cap is more easily accessible to the lineman than a switch on the side of the tank.

Clear, Positive Indication

Only the voltage for which the switch is in position is seen on the top of the switch, so there is no possibility of confusion. For safety there are double stops, one internal, one external. It is not necessary to remove the tank cover to check switch position. Should the weatherproof cap be misplaced, no material damage will result, and switch is easily operated with a small wrench.

Let Us Supply Data, Details

L-M Round-Wound dual-rating transformers are available in various combinations from 2400 to 14,400 volts through 100 kva. Let us supply detailed information both on the design and on the ratings and sizes available. Ask the L-M Field Engineer—or if you prefer, write me at Line Material Industries, Transformer Division, Zanesville, Ohio.

356

LINE MATERIAL Industries *Distribution Transformers*

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON

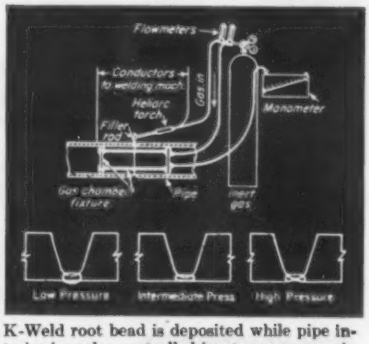
KELLOGG'S K-WELD® TECHNIQUE KEEPS PACE

During shop fabrication, *ninety* K-Welds . . . Kellogg's inert gas shielded technique of manual arc welding . . . were made by Kellogg on the Type 316 stainless main steam piping for Philadelphia Electric Company's Eddystone Station, Unit No. 1. All were heat treated after welding, at 1900-1950 F.

In the photo above, the K-Weld root bead already has been deposited —using 1/16 in. filler wire (16 Cr.-8 Ni.-2 Mo.). The operator is making the second pass by conventional manual arc welding. This and the remaining passes are made using covered electrodes (B&W 16-8-2) for this extremely heavy-walled section.

Inspections by liquid penetrant and radiography . . . *four for each weld* . . . were as follows: (1) After the first 5/8 in.; (2) Halfway between 5/8 in. and outer surface, provided the distance was greater than 3/4 in.; (3) On completion of weld; (4) After solution heat treatment. These inspections show the extent to which Kellogg goes, beyond code requirements in this case, to control quality of fabrication.

The M. W. Kellogg Company welcomes inquiries on its complete service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.



K-Weld root bead is deposited while pipe interior is under controlled inert gas pressure in specially designed portable gas chamber fixture. Diagram shows details of fixture, and how interior weld surface can be controlled by varying pressure.

Fabricated Products Sales Division

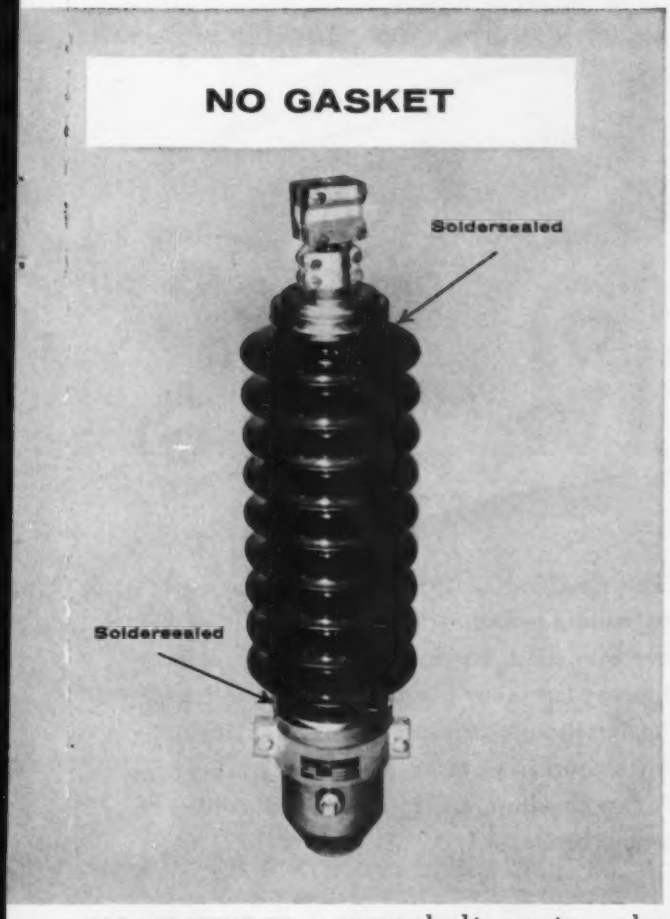
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., New York
Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

Why more and more utilities are adopting Anaconda Soldersealed Potheads



TODAY'S TREND TO more severe load temperature cycles demands potheads of greater tightness and reliability than ever. That's one reason more and more utilities are standardizing on Anaconda Soldersealed Potheads. Leakproof Anaconda Soldersealed Potheads will stand these more severe load cycles—there are no gaskets to tighten . . . all connections are soldered . . . with the difficult seals between porcelain and copper fittings *made in the factory*—not in the field! No moisture can be sucked into the pothead during cool part of load cycles. Outages and maintenance costs are reduced. Installation is sure and easy. Illustration above shows Anaconda Soldersealed Pothead, 46-kv voltage rating.

ANACONDA SOLDERSEALED POTHEADS are now made with an exclusive Double Action connection that eliminates the possibility of faulty field installation. This Double Action electrical connection is achieved by expanding the slotted stem against the inside of the copper hood and by the clamping action of aerial lug on the outside of the hood. Here's what else Anaconda's Double Action connection does: (1) prevents misalignment of cable during wiping and filling operation, (2) produces a permanent, sure electrical connection, (3) enables pothead to be easily dismantled and reinstalled, (4) eliminates possible damage to hood. Phantom drawing above shows how connection is made. 58234

Anaconda Soldersealed Potheads are available in 1/C type up to 46 kv for indoor or outdoor service—stocked, ready for delivery. Write for Bulletin C-79-1330. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA®**

FOR **SOLDERSEALED POTHEADS**

"Here's a really USABLE PLIER"

Says Ray Lindner of Buffalo, N. Y., recognized as the expert mechanic who can "fix it" when others fail. Mr. Lindner has been a mechanic for 40 years and owner and operator of Lindner's Garage for 33 years.

"CRESTOGRIP" PLIER No. P210. Retails for $3.00. If your hardware dealer can't supply you, order from the factory. $3.00 postpaid.

GET YOUR COPY!

Ideas and guidance for the professional and amateur mechanic. Forty pages of *help*... profusely illustrated. Proven ways of doing it easier with good hand tools. A new and revised edition of a "how-to-do-it booklet" that mechanics and industrial arts teachers by the tens of thousands have endorsed. Send 10¢ to cover postage, or GET A FREE COPY with the purchase of *any* CRESCENT TOOL. Ask your local hardware dealer. This offer is limited to the continental U. S. A. SEND A DIME TODAY! OR ASK YOUR HARDWARE DEALER FOR YOUR FREE COPY as explained above.

"This CRESTOGRIP Plier grips better with less handle pressure than any utility plier I have ever used. Its box joint is the reason. Ordinary lap joints generate much more frictional resistance. Crescent's box joint is not only smoother working but much stronger. It's easy to adjust, easy to use...a really different and better tool!"

QUICK, POSITIVE ADJUSTMENT

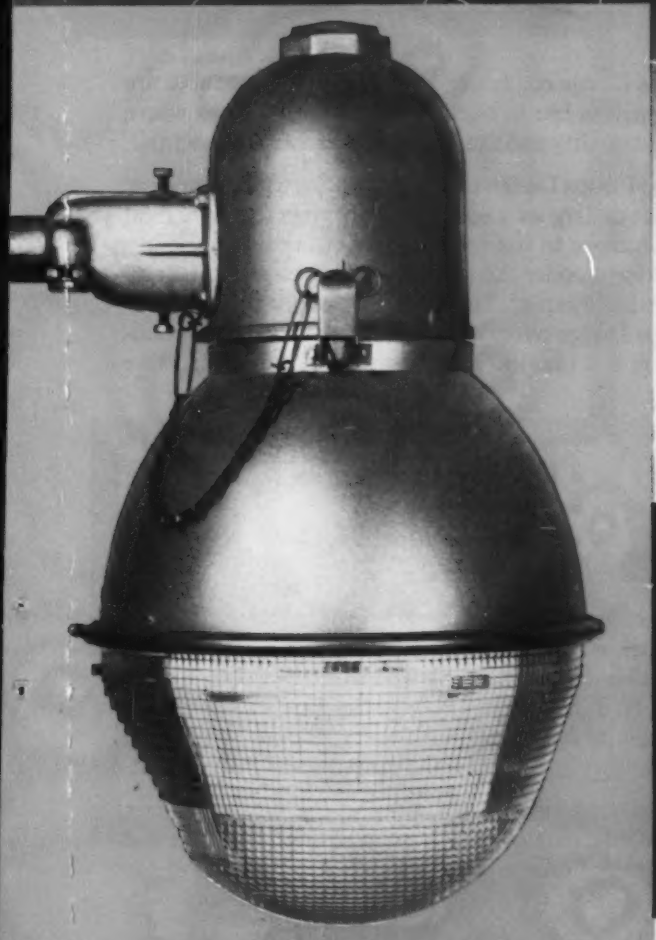
This cut-away view shows joint construction with its extra generous bearing surface at the arrow point.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

New in Street Lighting

THE FIRST 3-WAY TYPE I REFRACTOR



INTRODUCED AND OFFERED ONLY BY JOSLYN FOR THE EFFICIENT AND ECONOMICAL LIGHTING OF "T" INTERSECTIONS

Joslyn and Holophane have developed this new and much-needed luminaire with refracting glassware to produce 3 distinct, high angle beams. This unique design provides for long spacing and high pavement brightness at any "T" intersection without the use of deflecting shields. Optical assemblies will fit any standard EEI-NEMA head —refractor is interchangeable with other refractors on Joslyn Standard Enclosed Luminaires.

JOSLYN MFG. AND SUPPLY CO.

155 North Wacker Drive—Chicago 9, Illinois

If you need condenser and heat exchanger tubes for critical service...

Specify **Phelps Dodge**... a major supplier for nuclear projects!

Phelps Dodge condenser and heat exchanger tubes are currently in use in nuclear energy applications where highest quality and exacting specifications are essential.

Every Phelps Dodge tube intended for use in a nuclear project undergoes a series of severe tests to assure rigid conformance to the required specifications and ability to perform under the rigorous service conditions found in this highly specialized field. Testing facilities used by Phelps Dodge cover not only standard ASTM specifications but also include these special non-destructive tests:

- Eddy-current inspection
- Dye penetrant test
- Ultrasonic inspection

To keep pace with the steadily growing importance of the nuclear power field, Phelps Dodge will soon open one of the largest tube mills in the world at South Brunswick, N. J. This mill will have the most modern automatic tube fabricating machinery, the finest research laboratories and the most advanced testing equipment.

Inquiries regarding your condenser and heat exchanger tube needs, particularly those requiring Electronic and Penetrant Tests, are invited.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 PARK AVENUE, NEW YORK 22, N. Y.

PD

VERSATILE

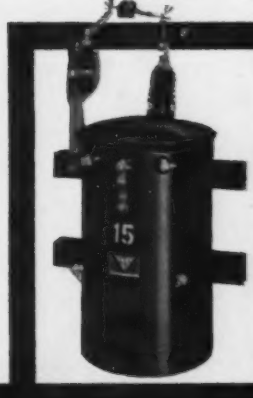
RT&E

Designs distribution transformers in standard and special styles to meet all requirements

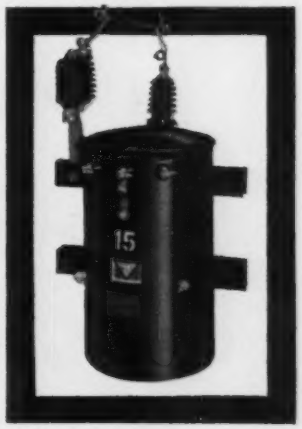
Conventional
2400 V. — 25 KVA
Typical Construction
4800 V. and below
5 — 25 KVA

Completely Self Protected
7200 V. — 15 KVA
Typical Construction
7200 V. thru 14,400 V.
5 — 25 KVA

Duplex
7200 V. — 10/15 KVA
Typical Construction
7200 V. — 7620 V.



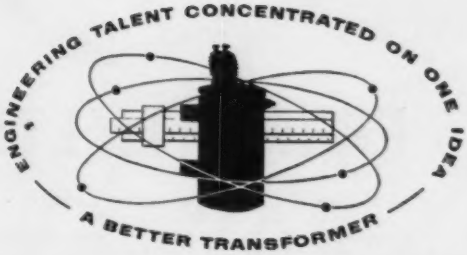
Protected with Double Gap and Loadguard
7200 V. — 15 KVA
Typical Construction
7200 — 14,400 V.
3 — 25 KVA



Protected with Arrester and Loadguard
7200 V. — 15 KVA
Typical Construction
7200 V. — 14,400 V.
3 — 25 KVA

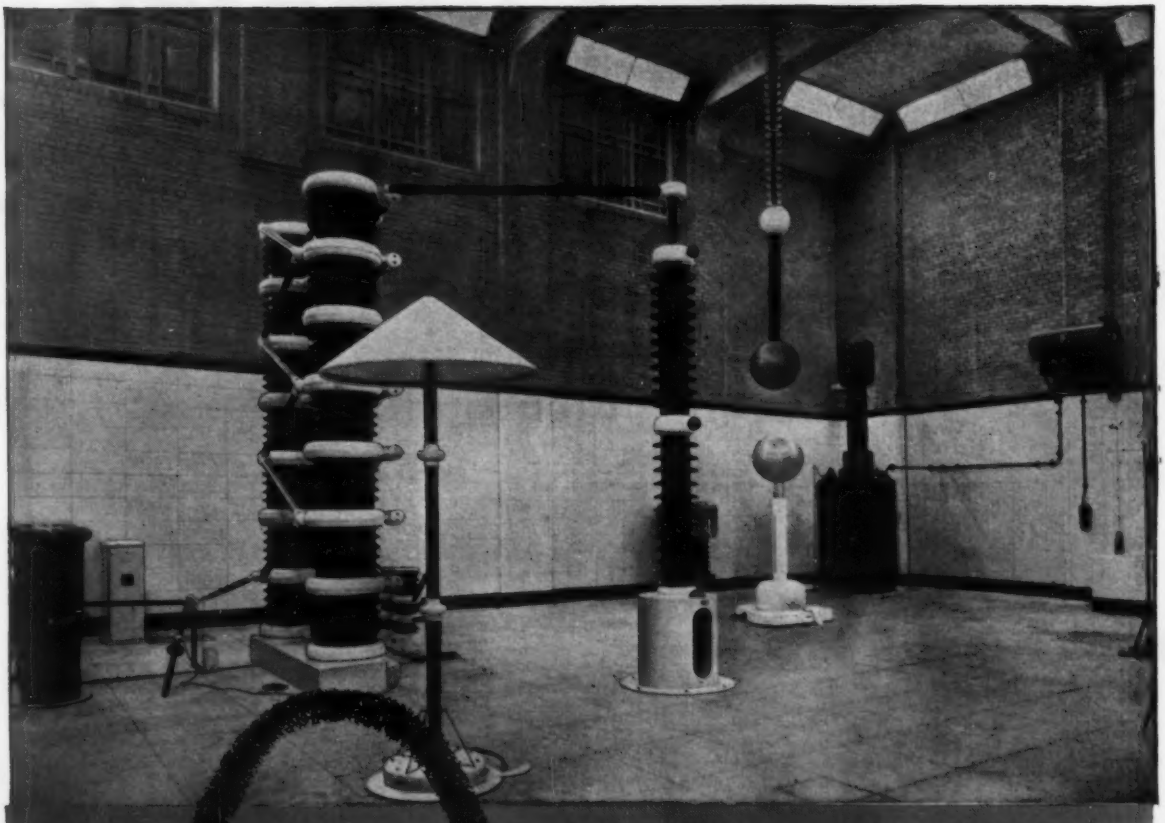
Dual Voltage
2400 V. x 7200 V. — 10 KVA
Typical Construction
Combinations thru 14,400 V.
5 — 25 KVA

Conventional
7200 V. — 100 KVA
Typical Construction
7200 V. — 14,400 V.
75 — 100 KVA



RT&E CORPORATION
WAUKESHA, WISCONSIN • PORTLAND, OREGON

V



Ferranti High Voltage Testing Equipment installed at the Manchester College of Science and Technology

All the testing equipment illustrated has been supplied by Ferranti Ltd. and is installed at the Manchester College of Science and Technology, Manchester, England. It consists of:

330,000 volt, 100 kVA single phase 50 cycle Testing Transformer and Control Equipment.

750 mm Sphere Gap.

1,400,000 volt, 2 column Impulse Generator complete with Control Equipment and Cathode Ray Oscillograph.

FERRANTI ARE SPECIALISTS in the manufacture of AC and DC Equipments for all kinds of routine and research testing, and are backed by 75 years' experience in the manufacture and development of electrical apparatus.

F FERRANTI

FERRANTI LTD

Head Office: HOLLINWOOD · LANCS · ENGLAND
London Office: KERN HOUSE · 36 KINGSWAY · W.C.2
NEW YORK: Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20
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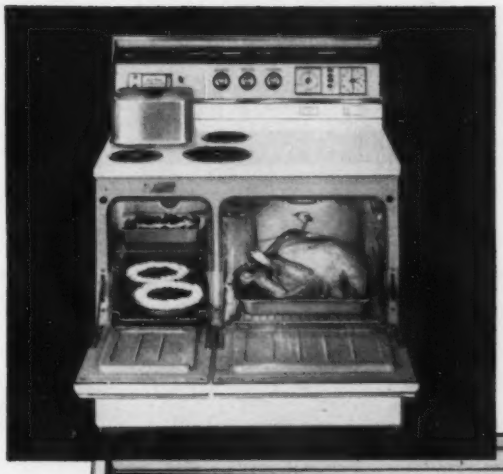
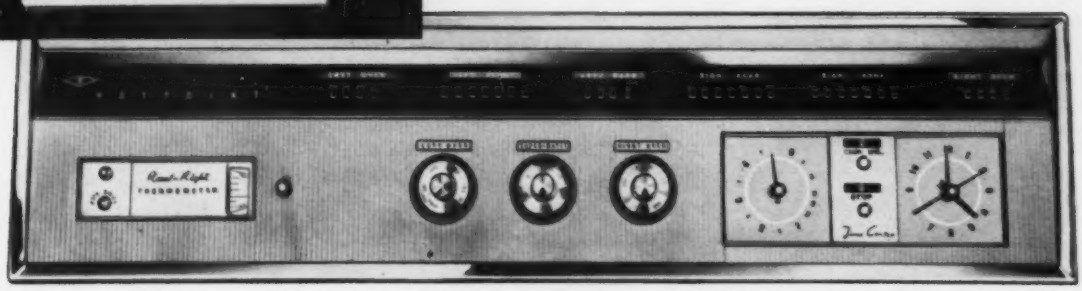
FT 714

PUT FULL HOUSEPOWER TO WORK

Hotpoint ELECTRIC RANGES

have the Difference that builds load and revenue... automatically!



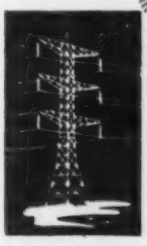


Hotpoint Electric Ranges help you build sales, load and revenue with all of the brilliant advances in quality, styling and completely automatic operation that make up the Hotpoint Difference. For example, the distinctive new control panel above provides automatic command of all surface and oven units—both time and temperature—at the touch of a button.

There's an optional new "thawer oven" that thaws frozen foods faster, doubles as a surface baking unit. And a new "touch open" storage drawer that glides out in response to a touch of the toe or hand. An exclusive meat thermometer in the Super Oven, controlled with one simple setting, signals when the roast or fowl is done just right.

These imaginative, yet practical advantages are just a few samples of the sale-exciting features offered by the dramatic Hotpoint Difference. Hotpoint Ranges will help you put more POWER in "Housepower"— more LIVING in "Live Better—Electrically!"

LIVE BETTER ELECTRICALLY



LOOK FOR THAT **Hotpoint** ***DIFFERENCE***

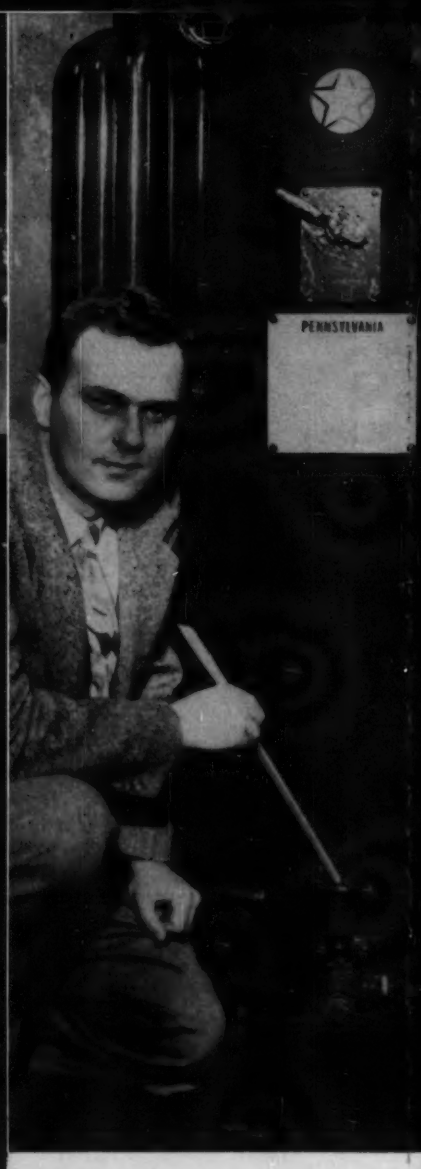
(your customers do!)

4-step finish gives lasting protection

Thousands of installations have proved the long-lasting quality of the Pole Star four-step finish. It begins with shot-blasting of all external surfaces, to remove scale, grease and dirt, and to provide "toothage" for adhesion of the first coat of paint. Then, three coats of paint are applied. The first two are flowed on to assure complete coverage. The third, finish coat, is sprayed.

Freon gas test okays all seams

Gasketed and welded joints are checked with the highly reliable freon gas leak detection test. The transformer is placed under positive gas pressure with a charge of freon gas. If *any* gas leaks through the joints of tank, cover, or bushings, it is drawn into the electronic "sniffer gun" to an electronic detector circuit that actuates an alarm. If a leak is detected, the faulty seal is corrected and retested.



"Low-Set" valve drains entire tank

Intermediate-size Pole Star transformers are now equipped with the Pennsylvania "low-set" power transformer drain valve. Now, it is no longer necessary to tip the transformer or apply internal pressure to completely drain the tank. As a result, there will be no mixture of old and new oil—a precaution that can pay off in additional years of trouble-free service.

Controlled tube production pays off in quality

To maintain consistently high quality, the entire production of cooling tubes and radiators is handled in Pennsylvania's own plant. Facilities include a modern electric-weld tube mill. Details such as the welding coolant, seam quality, and storage procedure are under constant surveillance. Rigid control in the production of this important transformer component makes a difference as the years of service begin to add up.

Rugged base makes maintenance easier

Welded solidly to the tank, the base of intermediate Pole Stars has four large openings for ventilation, to prevent condensation on the tank bottom. These openings also facilitate cleaning and painting in the field. To facilitate jacking, base jacklugs extend either between or beyond tubes and radiators. The transformer can be rolled in any direction.

externally, too . . . you get power transformer ruggedness with intermediate

PENNSYLVANIA POLE STAR DISTRIBUTION TRANSFORMERS

250 through 500 kva

a product of

Pennsylvania Transformer Division

McGRAW EDISON COMPANY

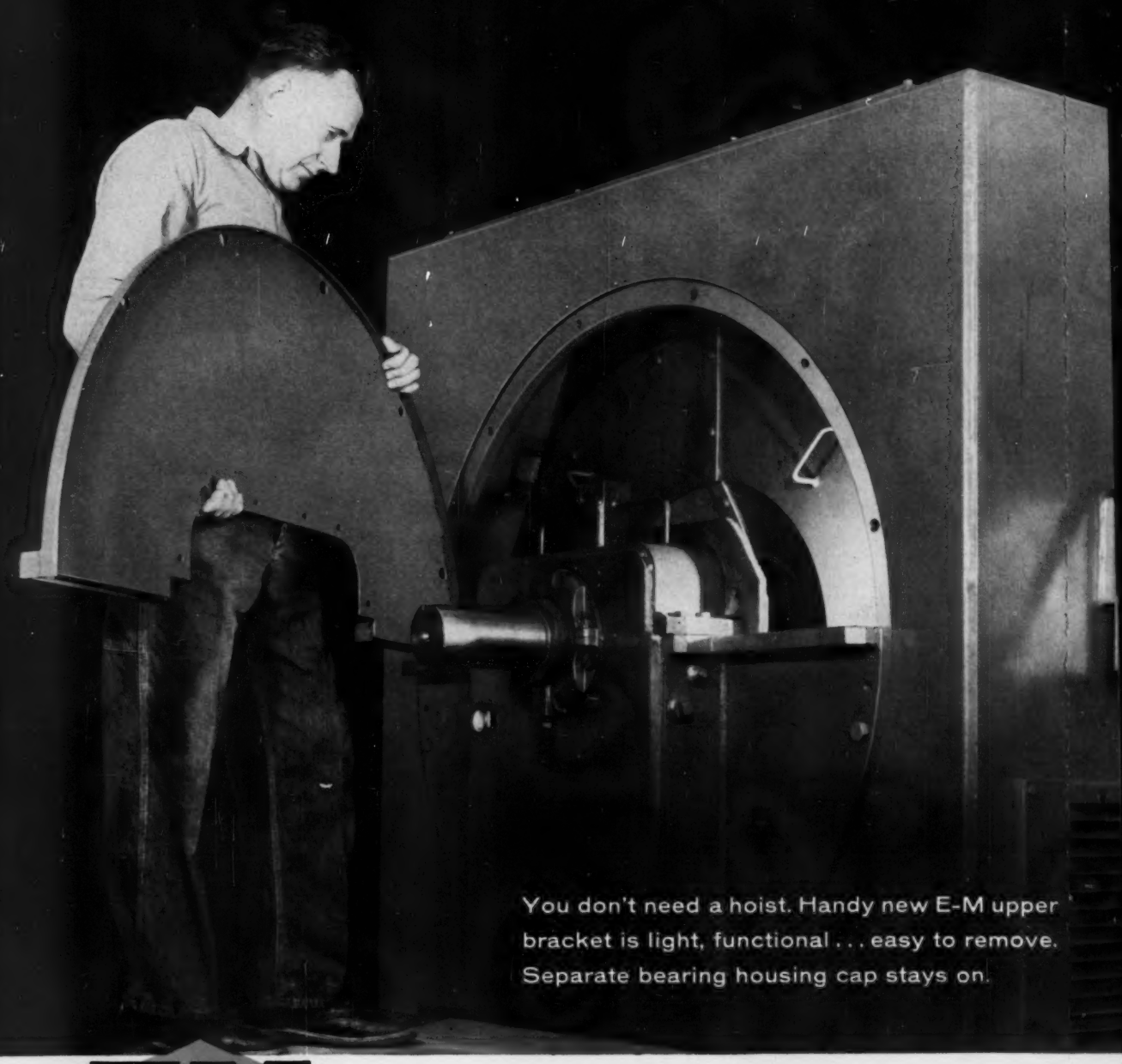
Canonsburg, Pennsylvania

McGRAW EDISON

POLE STAR

NOW Save costly man-hours, reduce downtime with the new E-M Straight-Up-Ventilated Boiler Feed Pump Motor. It gives you . . .

Quick and Easy Access



You don't need a hoist. Handy new E-M upper bracket is light, functional . . . easy to remove. Separate bearing housing cap stays on.

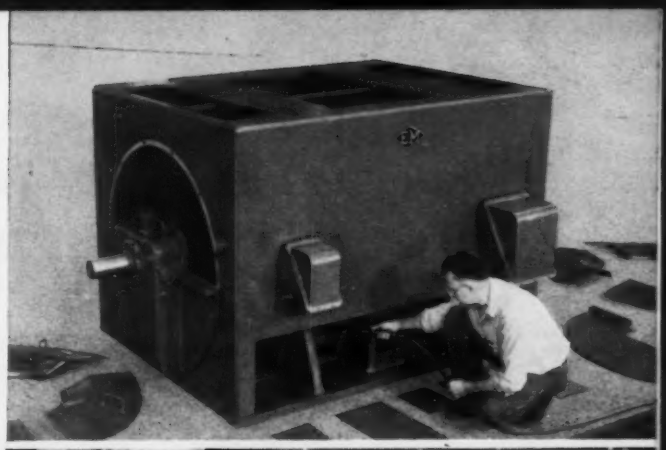
E-M

1300-TPA-2138

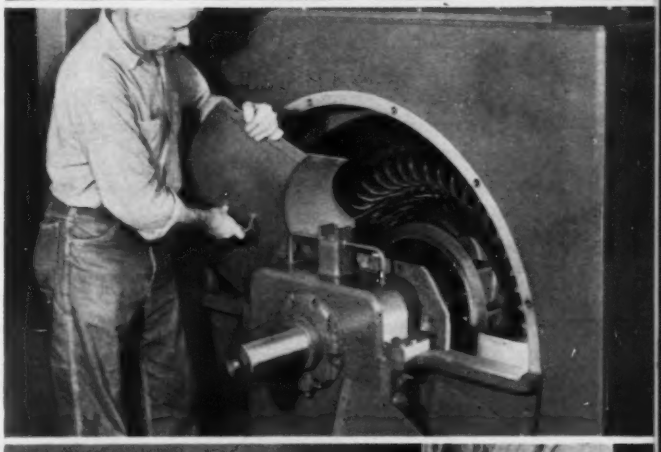
ELECTRIC MACHINERY

Builders of the new pump motor

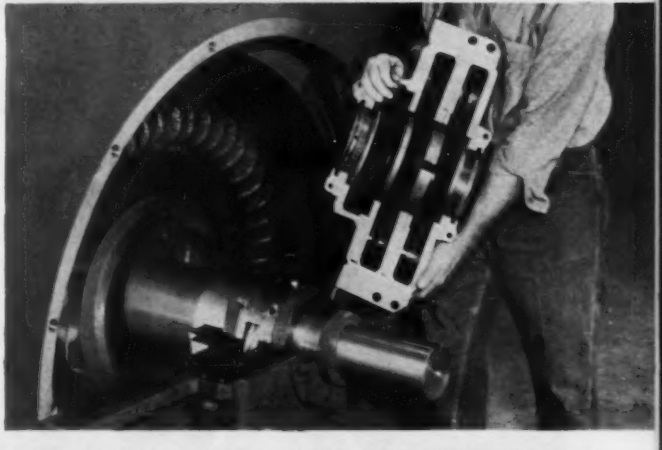
It's easy to remove louvers —just unbolt, lift off. Access plates let you clean thoroughly behind stator core.



Coils are readily checked for condition and cleanliness. Four-section air baffle comes out easily without taking off lower bearing bracket.

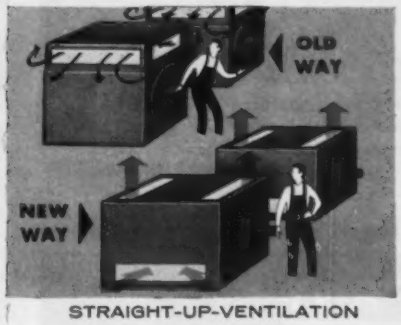


Just lift the cap to inspect bearings. Raise the rotor shaft to roll out the lower bearing half.

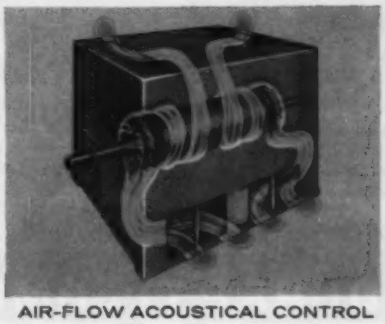


Learn more about the motor that's a pleasure to service. Ask your nearby E-M Sales Engineer and write to the factory for your copy of illustrated brochure No. 1134-W.

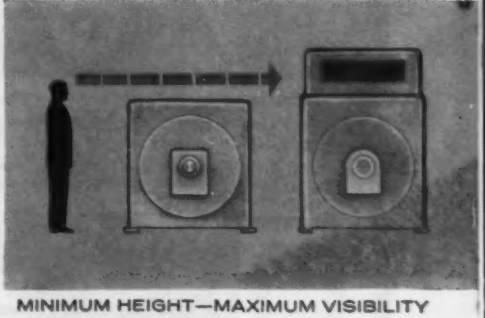
More of the MANY BIG DIFFERENCES that MAKE THE DIFFERENCE



STRAIGHT-UP-VENTILATION



AIR-FLOW ACOUSTICAL CONTROL



MINIMUM HEIGHT—MAXIMUM VISIBILITY

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

When you buy Motor Starters—

YOU PAY FOR OVERLOAD PROTECTION

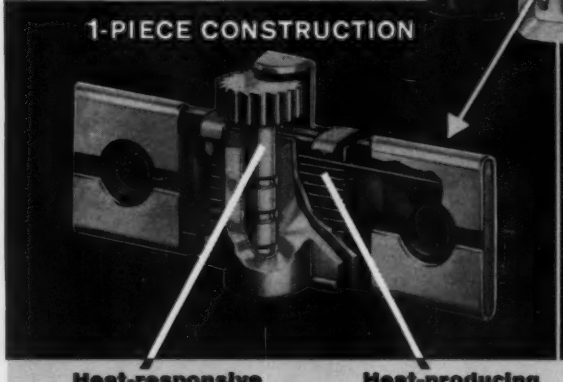
Only ONE-PIECE Overload Relays give 100% Protection • Only with ONE-PIECE construction can you *know* you've installed the heater correctly. Only with ONE-PIECE construction can you *know* the heater is exactly centered, or properly positioned, so that it performs according to its rating. Only with ONE-PIECE construction can you *know* your motors have full protection.

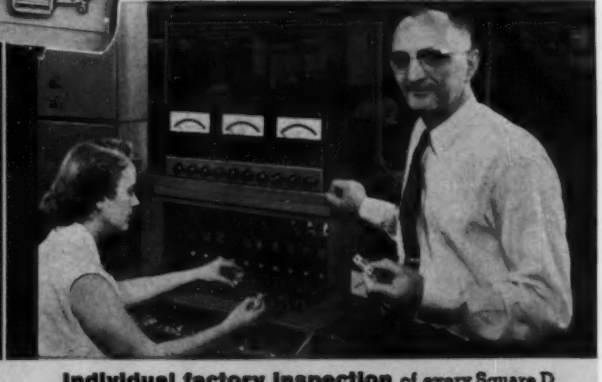
Only Square D has ONE-PIECE Construction • ONE-PIECE construction *eliminates* any possibility of heater misalignment. Square D melting alloy thermal overload relays can be installed only one way. They are tamper-proof. They are factory-assembled, are *individually* calibrated and tested. Repeated tripping will not affect accuracy.

Insist on Square D melting alloy thermal overload relays

Write for Bulletin SM-275 for the complete story on Square D starters with ONE-PIECE thermal overload relays. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

...BE SURE YOU GET IT!





Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

Individual factory inspection of every Square D melting alloy thermal overload relay means performance you can trust. Each unit is calibrated and thoroughly tested to make sure it will perform according to its rating.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

new high pressure closure for Ross feedwater heaters

Open for your inspection, during tube welding, this is the business end of a Ross Feedwater Heater. Take an inside look at the most unique High Pressure Closure in the business. It's brand new.

Only four major parts complete the assembly and she's ready to perk . . . pass partition cover, channel cover, two flange rings. That's all *you'll* need to handle at maintenance time. *Simple* is the word!

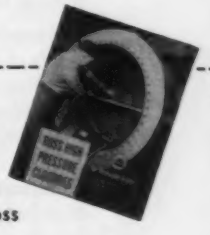
. . . so is *ruggedness*. The exceptionally high safety factor built into the load carrying cover and channel is more than double ASME Code requirements. Construction prevents overload of main engagements when tightening studs. Differential expansions between channel and cover do not effect channel wall, while bearing surfaces are spaced identically for uniform load. Temperature stresses from start-ups or load changes are virtually non-existent. There's more . . . much more!

American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
ROSS HEAT EXCHANGER DIVISION

NEW BULLETIN

You'll have to see the detailed design features of this new Ross development to fully appreciate the tremendous advantages. They are illustrated and described in new Bulletin 201.1K1. Mail coupon for your copy.



AMERICAN-STANDARD
ROSS HEAT EXCHANGER DIVISION
BUFFALO 5, N. Y.

Please send your new Bulletin 201.1K1 describing high pressure closures for Ross Feedwater Heaters.

NAME _____ TITLE _____

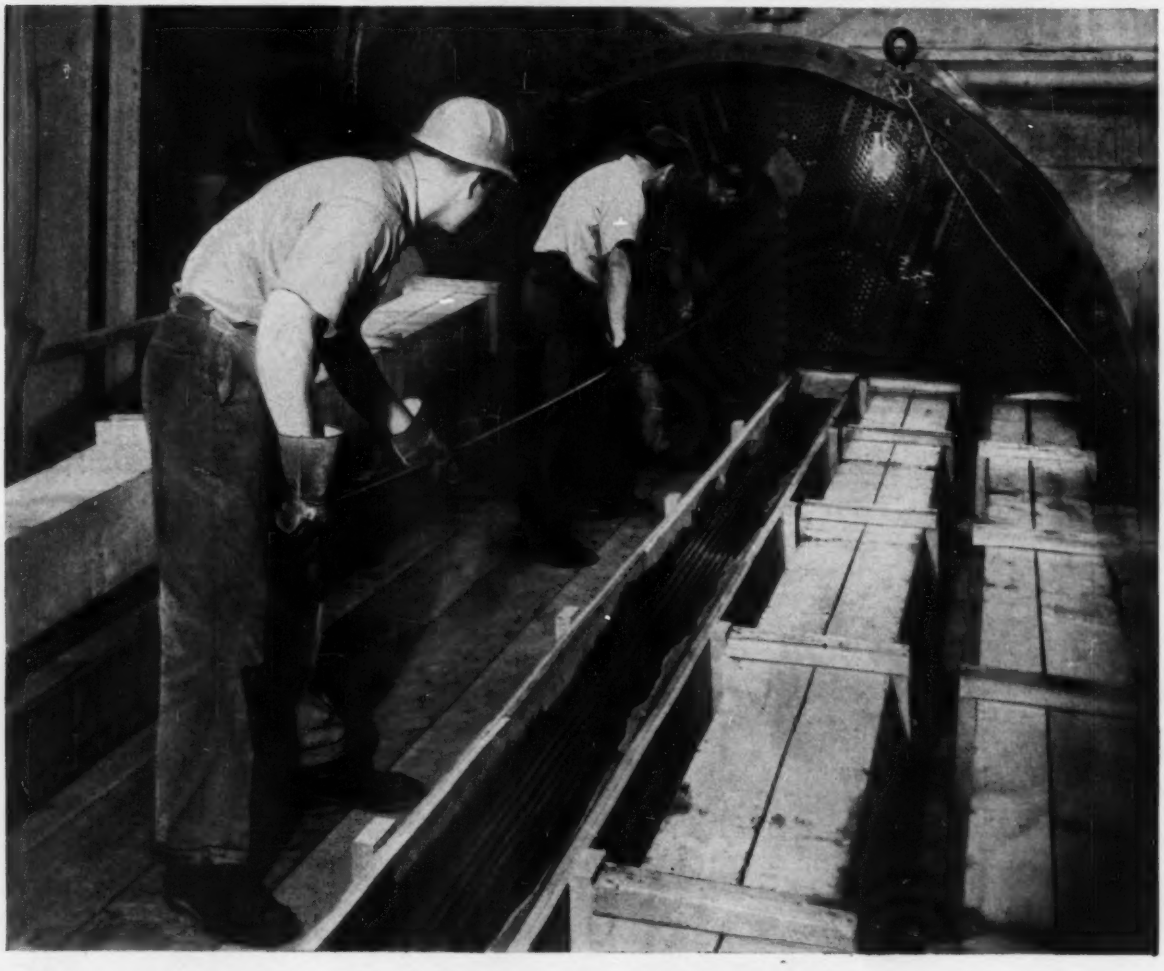
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

KW

TUBING OPERATION for divided water box, two-pass condenser. Complete unit has 95,000 sq. ft. condensing surface, serves 125,000 KW steam turbine-generator operating at 1,800 psi pressure, 1,000° F. steam supplied by 950,000 lbs/hr boiler.



OVER EIGHTY MILES OF CHASE CONDENSER TUBE!

East coast power company tubes condenser serving 125,000 KW generator unit

An east coast power company has recently completed tubing a condenser serving a 125,000 KW steam-turbine generator, using nearly 15,000 arsenical aluminum brass tubes, each 28′3¼″ long, by ⅞″ O.D.

Arsenical aluminum brass has proved itself in hundreds of installations of Chase Condenser Tube. Outstanding resistance to impingement attack makes it particularly suitable for use in tidewater power stations, aboard ship and in some oil field installations as well. Chase makes condenser tube to meet any combination of water type, temperature, speed of flow and corrosion conditions—and is ready to provide technical assistance in meeting specific problems, based on years of experience in manufacture and specification of condenser tube. Bring your needs to your nearest Chase Representative, or write Chase at Waterbury 20, Connecticut.

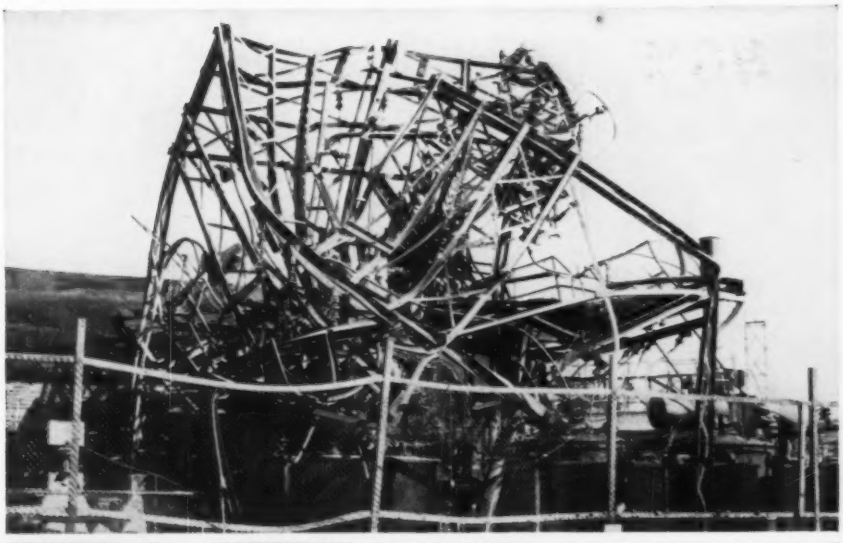
Chase

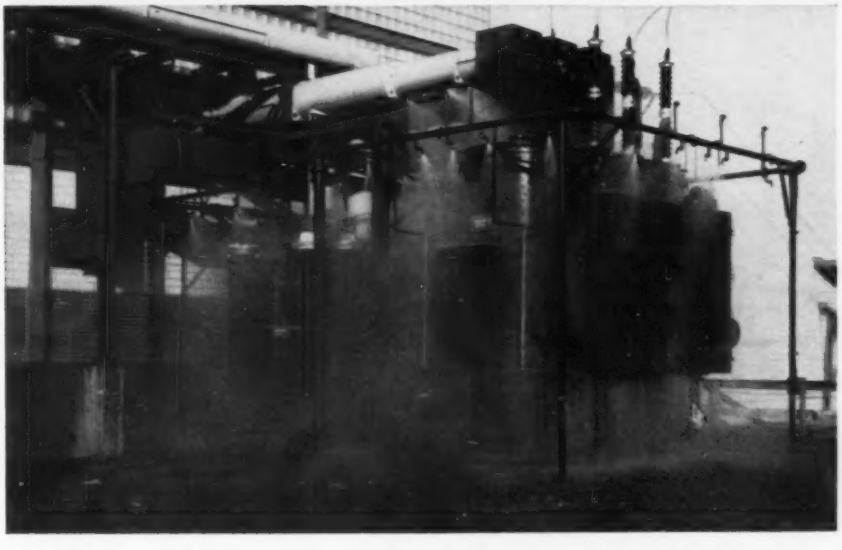
BRASS & COPPER CO.
WATERBURY 20, CONN.
Subsidiary of
Kennecott Copper Corporation

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

special hazard fires...





need Grinnell Special Hazard Protection

Fairly commonplace in industry today are special hazard areas, where special protection must be provided to assure against possible serious loss by fire. Grinnell, with 88 years' experience protecting against fire hazards of every description, has the most effective extinguishing agents and best systems for each type of hazard.

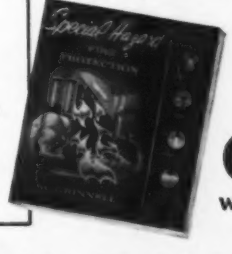
Remember, too, the installation of the proper Grinnell System usually serves to reduce fire insurance premiums drastically, often pays for itself in a few years!

FREE REFERENCE MANUAL! This new 44-page reference manual — "Special Hazard Fire Protection by Grinnell" — gives you a comprehensive picture of all the most advanced methods for Special Hazard fire protection. It includes explanations, applications, photographs, case histories of Grinnell systems and specialized equipment . . . and a Quick Selector Chart to help you determine the most effective system for your special fire hazard.

Write for your complimentary copy today. Grinnell Company, Inc., 277 West Exchange St., Providence, R. I.

TABLE OF CONTENTS

- Recognizing Your Special Hazards
- The Fire Triangle in Special Hazard Fire Protection
- Special Hazard Fire Terms Defined
- Water Spray Systems
- Selfcon Water Spray Systems
- Foam Systems
- Carbon Dioxide Systems
- Dry Chemical Systems
- Control Equipment and Devices
- Quick Selector Chart
- Research and Testing
- Sales, Engineering, Installation and Inspection Service

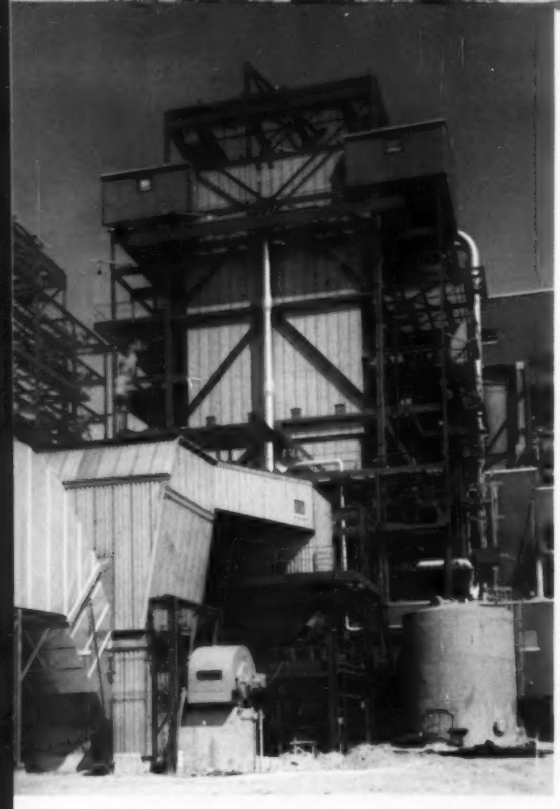


GRINNELL

WHENEVER FIRE PROTECTION IS INVOLVED

Manufacturing, Engineering, and Installation of Fire Protection Systems since 1870

NOW OPERATING - The First of Two Complete RILEY Reheat Boilers For Minnesota Power And Light Company At Its New Clay Boswell Station

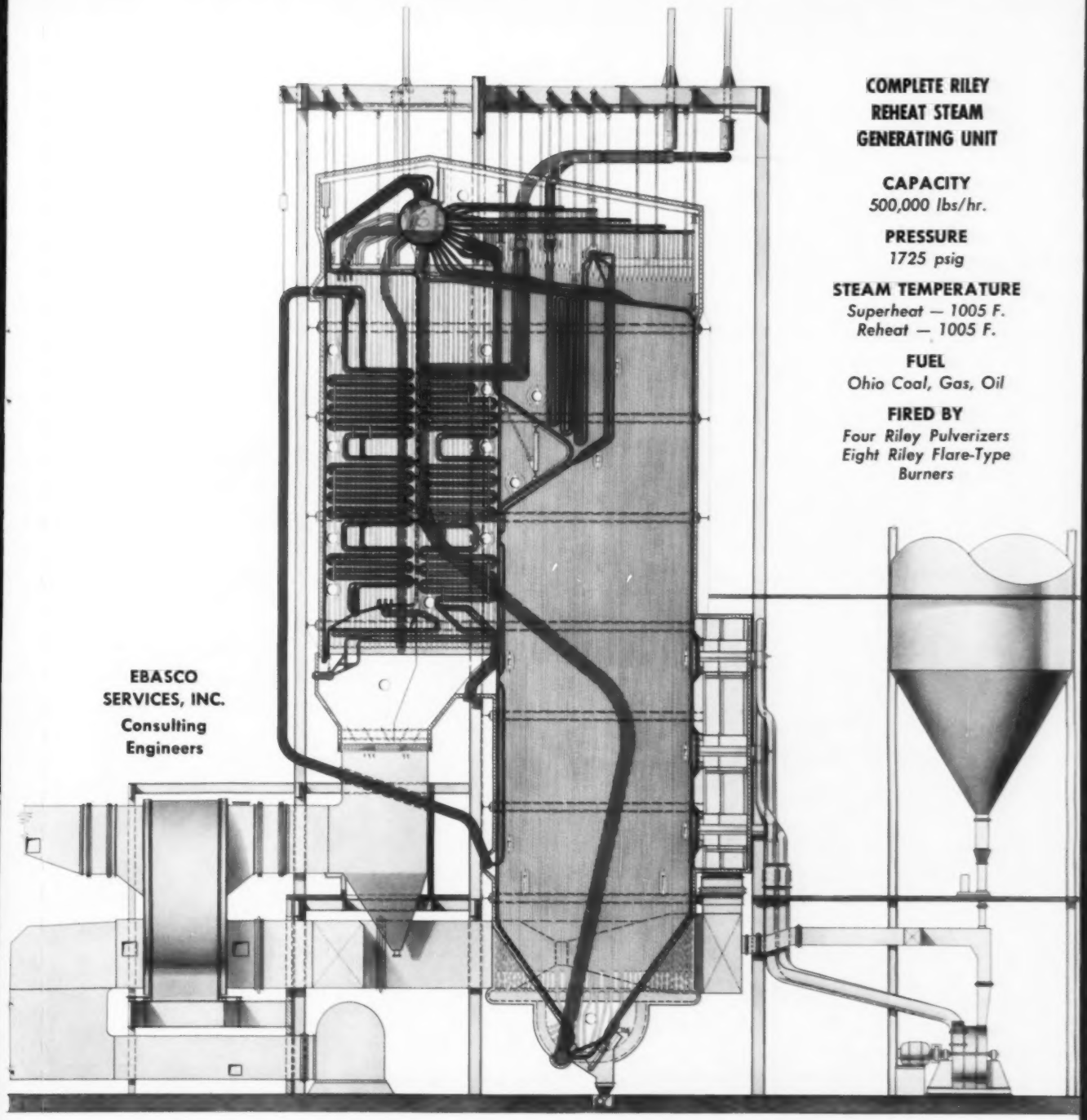


From World War II to the end of 1959 when the second Riley Steam Generating Unit at Clay Boswell Station is placed on the line, Minnesota Power & Light Company and its subsidiary, Superior Water, Light & Power Company* will have spent approximately $95,000,000 on expansion and modernization and $25,000,000 of it on its new Clay Boswell Steam Electric Station situated on 217 acres abutting Blackwater Lake and the Mississippi River at Cohasset near Grand Rapids, Minnesota.

This modern Minnesota central station has boilers, turbo generators, and a few auxiliaries placed outdoors, an increasingly popular trend in the design of power plants for northern sections of the United States.

The Riley boilers at Clay Boswell Station are fired by four Riley #550 Pulverizers and eight Riley Flare Type Burners. Each is designed with a capacity of 500,000 lbs/hr., 1550 operating pressure. Fuels are Ohio Coal with 2100 F Ash Fusion Temperatures and 13.10% ash, oil, gas. Superheat and reheat temperatures are maintained constant at 1005 F by automatic damper control of combustion gas flow, which eliminates, under normal day-to-day operating conditions, the need for water spray, heat exchangers, change in flame direction, and the operating and maintenance problems associated with these systems. The design of both Clay Boswell Riley boilers is distinguished by the Riley Single Header Water-Cooled Ash Hopper Bottom, one of many exclusive Riley money-saving design features.

*Superior Water, Light & Power Company also uses a Riley Pulverized Coal Fired Boiler.



COMPLETE RILEY REHEAT STEAM GENERATING UNIT

CAPACITY
500,000 lbs/hr.

PRESSURE
1725 psig

STEAM TEMPERATURE
Superheat — 1005 F.
Reheat — 1005 F.

FUEL
Ohio Coal, Gas, Oil

FIRED BY
Four Riley Pulverizers
Eight Riley Flare-Type Burners

EBASCO SERVICES, INC.
Consulting Engineers

For complete details on other Riley Central Station Designs — Reheat and Non-Reheat, Pressurized and Non-Pressurized, complete with Riley Fuel Burning Equipment: Stokers or Pulverizers and Burners, write: RILEY STOKER CORPORATION, WORCESTER, MASSACHUSETTS.
Offices in these principal cities: Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New York, Philadelphia, Pittsburgh, New Orleans, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse.

A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

RILEY
STEAM GENERATING & FUEL BURNING EQUIPMENT

Union Electric solves a crowded channel problem

with General Electric Progress Line mobile radio

Expansion plans at Missouri's Union Electric Company called for more radio-equipped trucks. But new trucks could not be handled by the existing radio system.

So Union Electric went to Ultra High Frequency for its new base stations at Alton and St. Charles and chose G-E Progress Line equipment.

For the utmost in reliability, General Electric's Progress Line now offers the widest variety of thermostatically-protected transistor-power mobile radios available, up to and including 100 watts in low band.

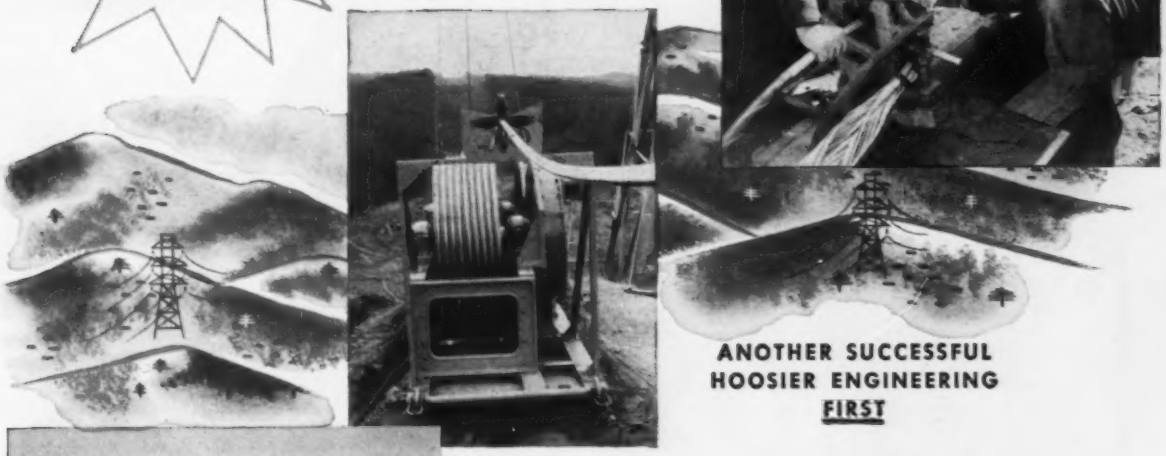
General Electric uses pre-tested communication-type tubes for longer service life . . . controlled reluctance microphones for the clearest possible voice fidelity. What's more, Progress Line equipment is completely interchangeable—chassis for chassis, even between mobiles and base stations—to speed servicing and reduce downtime.

The G-E communications consultant in your area can help you plan an efficient, low-cost radio system. Give him a call. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Dept. 9108-6, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Stringing 62 miles of second circuit on same tower with LIVE 330,000 volt line



ANOTHER SUCCESSFUL HOOSIER ENGINEERING FIRST

This recent installation presented a real challenge. Originally built by Hoosier in 1952, the increased demand on this West Virginia line required stringing a second circuit . . . without interruption of the first circuit. Hoosier Engineers developed special equipment for tension stringing . . . and for the first time in power history successfully installed a second circuit on an existing line while the first circuit was energized and working at 330,000 volts.

HOOSIER *Engineering Company*

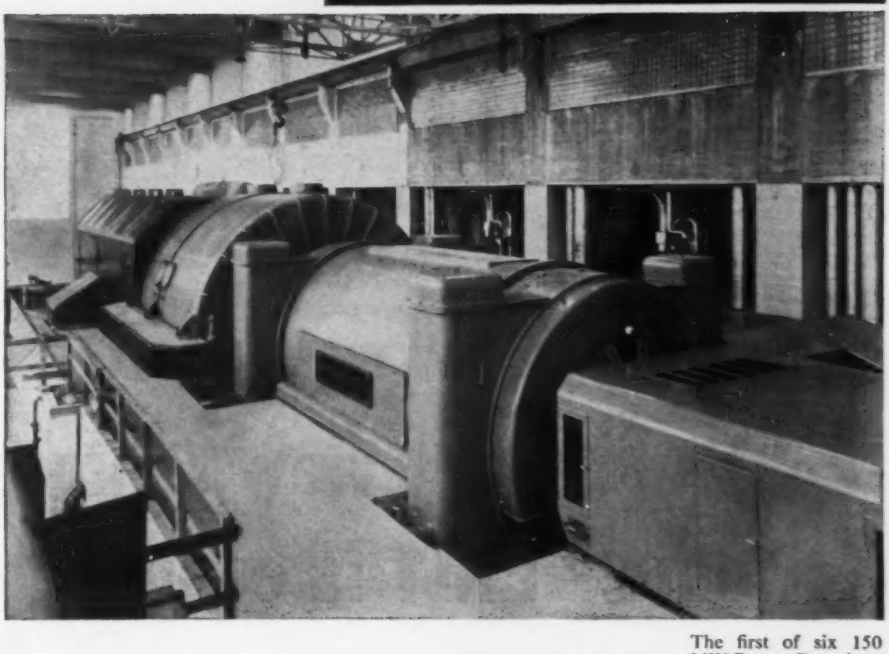
ERECTION AND MAINTENANCE OF TRANSMISSION LINES

inexhaustible energy for the future's heaviest loads

B&O **BITUMINOUS COALS FOR EVERY PURPOSE**

Ask our man! BALTIMORE & OHIO RAILROAD—BALTIMORE 1, MD. PHONE LExington 9-0400

brown boveri STEAM TURBINE GENERATOR SETS



AVAILABLE SIZES

(Complying with ASME-AIEE Preferred Standards)

11/12.65 MW
20/22 MW
30/33 MW
40/44 MW
60/66 MW
100/110 MW
125/137.5 MW
150/165 MW
200/220 MW
250 MW
300 MW
500 MW

The first of six 150 MW Brown Boveri reheat turbine generator sets in a modern power plant. Many similar and larger units have been in operation for years.

Two of the basic reasons why Brown Boveri turbine generator sets are preferred by economy-minded utility companies . . .

1—*Guaranteed efficiency* is invariably matched (and often exceeded) in actual operation.

2—First cost represents *very substantial dollar savings.*

Write for details!

BROWN BOVERI CORPORATION

19 RECTOR STREET —— NEW YORK 6, N.Y.

BROWN BOVERI

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A real shine! Visible proof that the inside surface of Rome's EMT is slippery smooth.

"Tape's eye view" shows why Rome's EMT is easiest to fish

That shine you see is the reason fish tape won't "hang up" when you use Rome's EMT.

The slick interior finish of Rome's EMT lets your fish tape slide through with an absolute minimum of resistance. Careful baking—under rigid control—produces a uniformly smooth enamel-like finish inside Rome's EMT.

In a test conducted by the Anstice Company, a completely unbiased party, Rome's EMT came out first in fishability. Three ten-foot lengths of ½" EMT, Rome's and two competitive samples, were formed into identical figures containing eight bends. The ½" fish tape used in the test easily passed through the eight bends in Rome's EMT, but "hung up" on one of the bends in both competitive samples.

Strong weld In another test to determine the strength of the weld on Rome's EMT, a sample was squeezed, flared, flattened, and expanded. In each case, the weld proved to be as strong as the metal itself.

Easy bending The strength of Rome's EMT interferes in no way with its ductility. You can make bends—even intricate ones—quickly and easily.

Corrosion resistance A uniformly electrogalvanized exterior finish protects your installation against corrosion. Long dependable service life is assured.

Use easy-fishing, easy-bending Rome EMT on your next job. Contact your nearest Rome Cable representative for more information—or write to Department 905, Rome Cable Corporation, Torrance, California.

ROME CABLE

CORPORATION

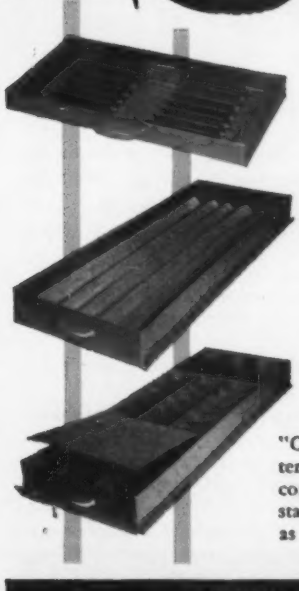
public utility men prefer—

YORK-HOOVER
YMR-76 Service Bodies

MODERN

PROVEN

EFFICIENT



"Custom" features such as material drawers with adjustable compartments are available as standard or optional equipment, as required.

LESS SERVICE HOURS...

plus extra savings in operators time are the results obtained by hundreds of YMR-76 Service Bodies in operation today. That's because YMR-76 units are compact and rugged . . . provide ample and convenient carrying space for materials and tools . . . with capacity for adjustment to meet changing conditions. Write for complete details, price and delivery information today!

CLIP AND MAIL TODAY!

Dept. 1E, York-Hoover Corporation
York, Penna.

Please send me a copy of Bulletin No. 942 covering your YMR-76 Service Body.

Name_____

Company_____

Address_____

City and State_____

BODY DIVISION
YORK-HOOVER CORPORATION
YORK, PENNSYLVANIA

CREATIVE ENGINEERING FOR THE PUBLIC UTILITY INDUSTRY SINCE 1892

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A R Cu. 8—1 0

BLACKBURN
COPPER TO
ALUMINUM
FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430

BERGEN GETS 8 LJUNGSTROMS® ...AND SOME REMARKABLE CUSTOMER SERVICE

Public Service's new Bergen Generating Station will be served by 8 large, horizontal Ljungstroms. Almost as important . . . the Ljungstroms will be serviced *throughout* their life by Air Preheater.

What's special about this customer service? For one thing, it's the considerable knowledge and talents of Air Preheater's engineers. They have been involved in nearly every conceivable type of boiler/preheater problem. They've seen how these problems can be handled. And they can put this experience to work for operators of Ljungstrom air preheaters.

Your Air Preheater engineer also makes regular calls to check the operation of every Ljungstrom – for as long as it's in service. (This now includes installations dating back to 1923.)

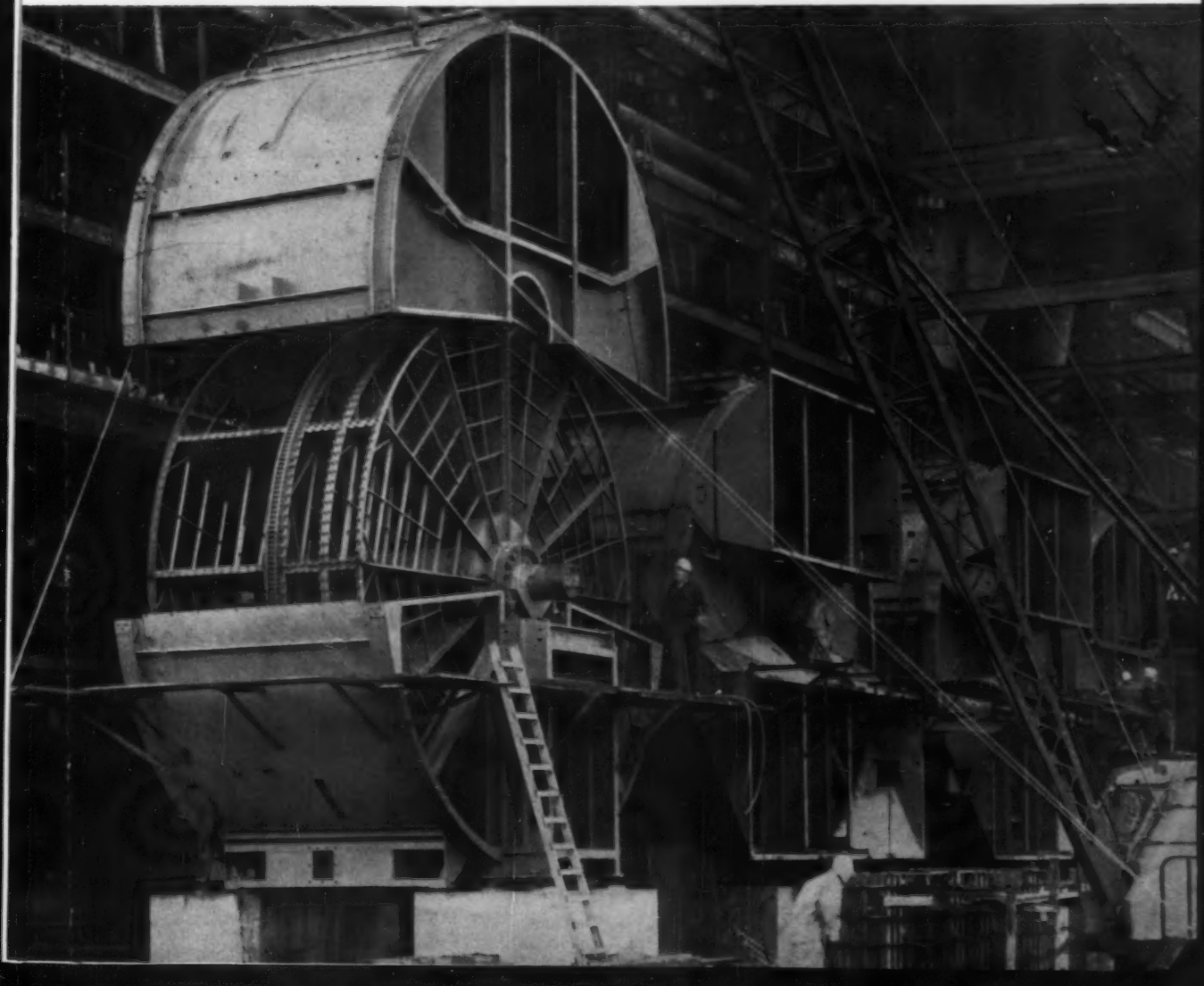
So, when you select a Ljungstrom, you're never entirely on your own. You *continue* to be the responsibility of a competent Ljungstrom engineer and benefit from his experience and knowledge. Maybe that's why 9 out of 10 preheaters sold are Ljungstroms.

Thirty-five tons of Ljungstrom rotor being lowered into place at the new Bergen Generating Station at Ridgefield, N. J. (When the heating elements are installed the rotor will weigh 150 tons.) This is one of eight preheaters being installed by Public Service Electric and Gas Co. to serve two boilers – each evaporating 1,900,000 lbs of steam/hr. The first boiler is to be fired early next year. Anticipated preheater outlet temperature is about 275 F.

Public Service is one of the first Northern utilities to use large-size horizontal preheaters. They have nine such horizontals in operation at their Linden Generating Station and have ordered eight more for their new Mercer Generating Station.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.



How Westinghouse Plowback of Earnings into Research brings you

POWER CIRCUIT BREAKER DESIGN AND PERFORMANCE IN A DISTRIBUTION BREAKER

A forward-looking breaker design program, coupled with thorough High Power Lab testing, produced the Type G frame-mounted, single-tank breaker . . . providing system protection and continuity of service unmatched in the industry! These distribution breakers are designed to the ASA Large Power Breaker Standards.

Top coordination of system relaying can be provided by separate phase and ground relays. Any type or combination of relays can be used to provide maximum flexibility. Varying system requirements can be met without changing basic breaker components.

The magnetic De-ion® grid and solder-sealed condenser bushing were adapted from big breakers to offer reliable high-voltage breaker performance.

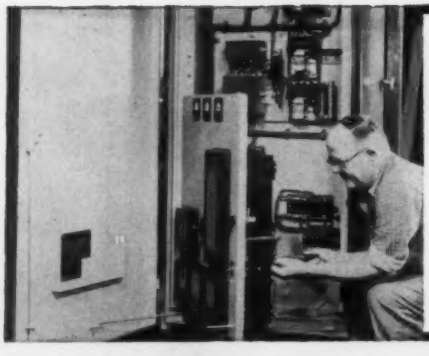
Exhaustive High Power Lab testing proved the soundness of the single-tank design . . . assuring big savings in inspection, adjustment and maintenance, plus the most efficient utilization of oil.

Type G breakers are available rated: 14.4 kv, 600-1200 amp, with interrupting capacity of 100-250 mva; and 23 kv, 600 amp, 250 mva. Maximum interrupting time: 5 cycles.

To learn how you can have big-breaker performance in your distribution substation breakers, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60958

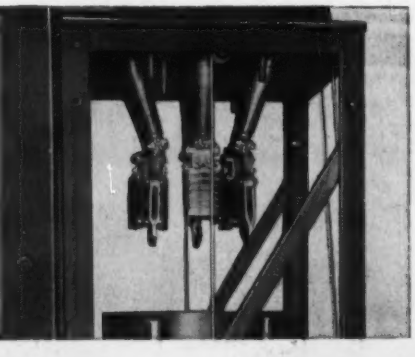
YOU CAN BE SURE...IF IT'S

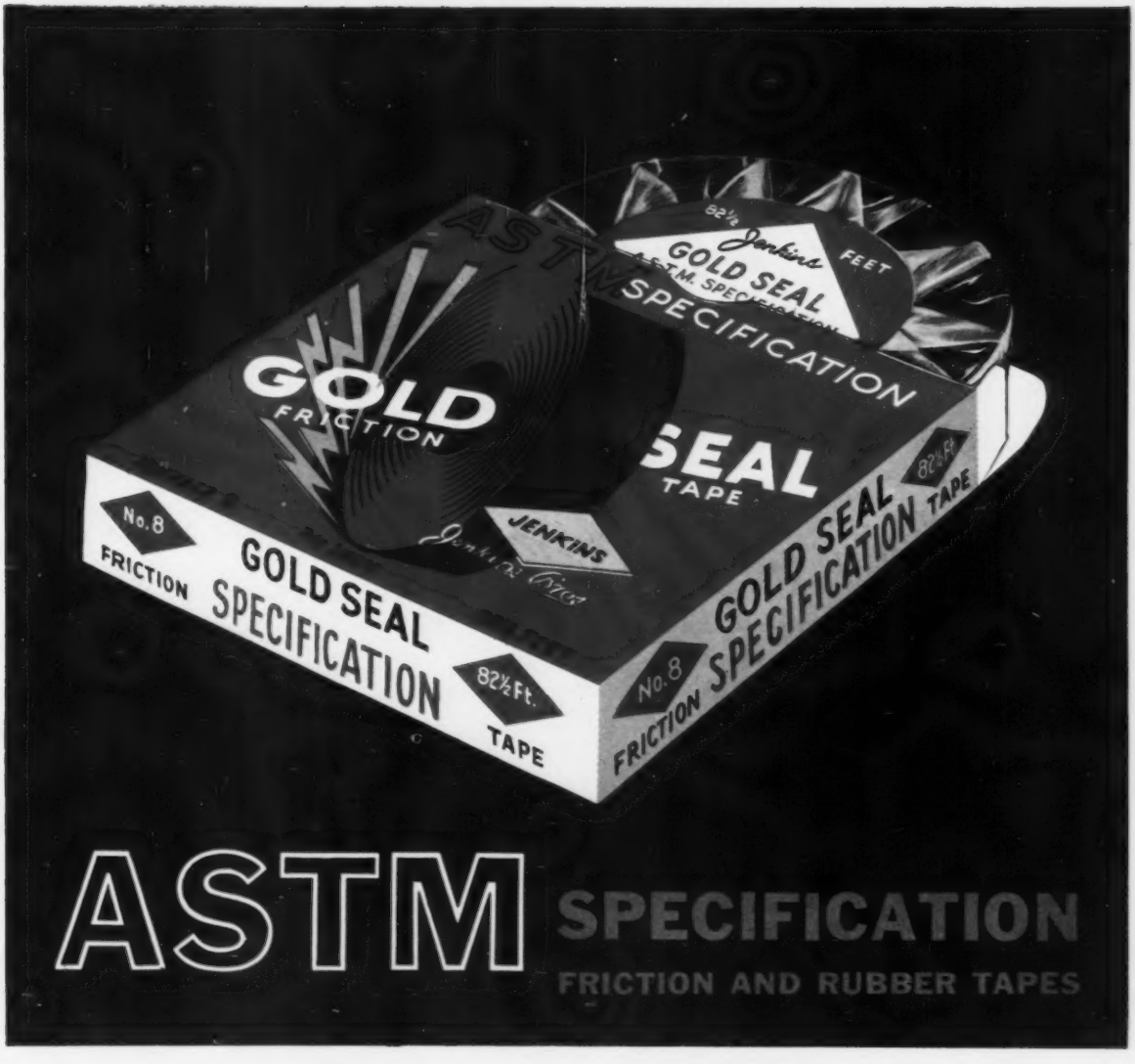
Westinghouse



Staggered interrupters give complete phase-to-phase insulation. Hinged moving contacts provide positive guiding action . . . simplest operating linkage. Since single-phase faults may occur more frequently on one particular phase, three phases in one tank make optimum use of all of the oil . . . minimize maintenance.

Relays and operating mechanism both located in cabinet of breaker to trim space requirements. Hinged relay panel provides easy accessibility for inspection or maintenance.





with the quality PLUS of the GOLD SEAL name

A high natural-tree rubber content, and rigid laboratory controls, assure a quality tape of lasting tack and fusion, with high dielectric properties for finishing an insulating splice.

Jenkins GOLD SEAL A.S.T.M. SPECIFICATION Tapes exceed the requirements specified by utilities. Available in two handy roll sizes – cellophane-wrapped and boxed, or cellophane-wrapped only.

Wherever exacting requirements are to be met, you can depend on GOLD SEAL SPECIFICATION Friction or Rubber Insulating Tapes.

JENKINS *Gold Seal Tape*

Product of
JENKINS BROS.
Rubber Division
100 Park Avenue
New York 17,

SILICONE RUBBER INSULATED *BY ROCKBESTOS* OFFER YOU:

Excellent dielectric strength — electrical properties remain constant from −130°F to +500°F.

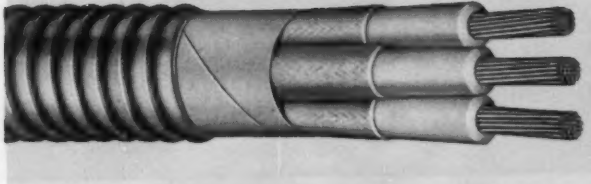
High heat resistance — better than any type rubber insulation. Long service life in temperatures to 125°C (power cables) and 200°C (other applications).

Excellent moisture resistance — unrestricted applications in wet or dry locations — equal to the best grades of rubber. No lead sheath required.

Greater ozone resistance than the best grades of rubber insulated cables.

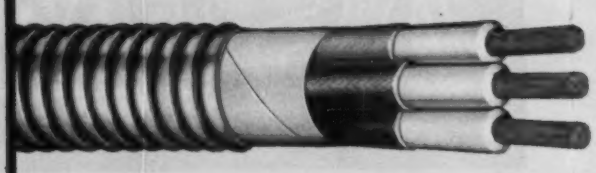
Excellent resistance to chemical attack — being chemically inert, silicone rubber insulations resist effects of lubricating oils and most corrosive atmospheres.

Long life — excellent resistance to weathering and aging.



600 and 5000 VOLT MULTI-CONDUCTOR POWER CABLE

Silicone rubber insulated power cable combined in a 3 or 4 conductor construction, with interlocked armor overall . . . easily installed with simple supports . . . eliminates conduit . . . greater current carrying capacity for economical power distribution.



MULTI-CONDUCTOR CONTROL CABLE

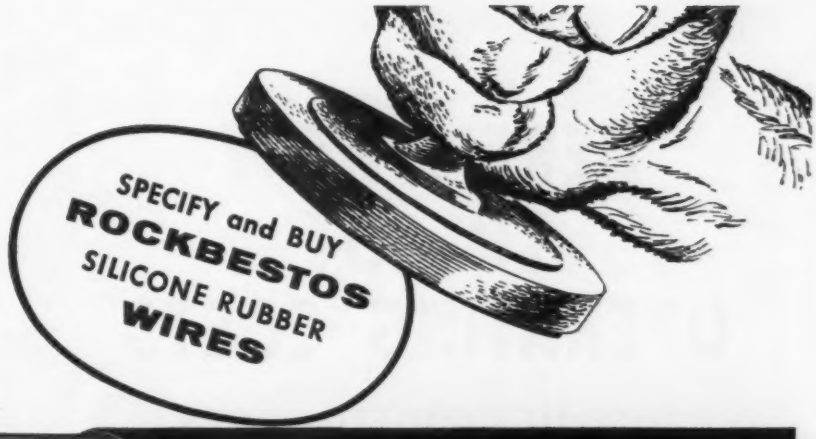
For use in steel mills, power stations, boiler rooms, automotive, ceramic and glass plants as well as other industries where control and signal circuits or control equipment are exposed to high ambient operating temperatures.

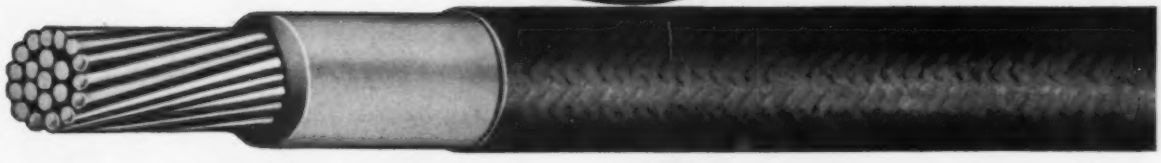
ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

New York • Cleveland • Chicago • Oakland • Los Angeles • Pittsburgh
St. Louis • Detroit • Seattle • Atlanta • Dallas

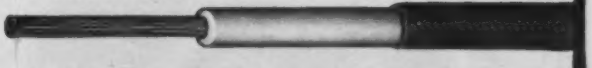
WIRES





SILICONE RUBBER INSULATED POWER CABLE
600 and 5000 VOLTS

For high temperature circuits either in wet or dry locations, exposed or in conduit. This cable is recommended for use in steel mills, power stations, heat treat areas, boiler rooms, foundries, smelters, etc.

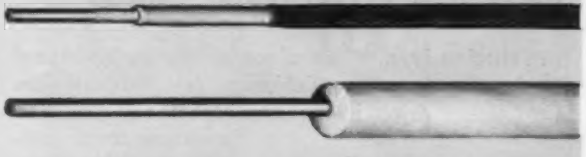


MOTOR LEAD and APPARATUS WIRES

For leads to motors, transformers, etc., requiring a flexible wire in high temperature locations or applications.

APPLIANCE and FIXTURE WIRES

For use in wiring high wattage units when operating temperatures reach 150°C and 200°C. Lighting fixtures, clothes dryers, electronic equipment, stoves, water heaters, ovens, therapeutic devices, space heaters are among the many products for which these wires are recommended.



HEATING CABLES and DEFROSTING WIRES

Heating cables are ideal for use in pipe heating, surface heating, roof de-icing and soil heating.

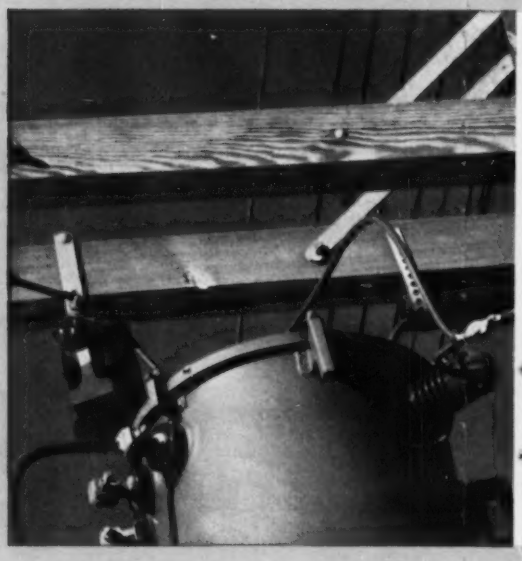
Defroster wires being odorless and tasteless are perfect for use as rapid defroster heating element in electric refrigerators and freezers.

ROCKBESTOS

For complete details on Rockbestos Silicone Rubber Insulated Wires and Cables send for Catalog SR58.

HERE'S HOW TO CUT OPERATING COSTS

Install Transformers That Stay Young, Live Longer



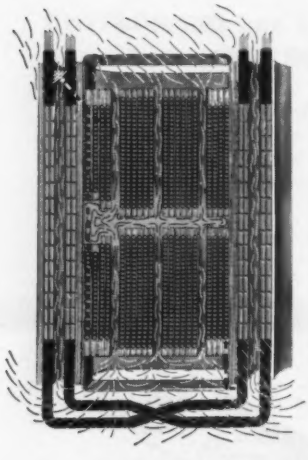
WHAT SHORTENS TRANSFORMER LIFE?

Heat and moisture do more to shorten transformer life than anything else. Once moisture gets into the oil, sludge forms—oil circulation slows down—winding temperatures increase—and insulation gradually weakens. This begins the aging process.

WHAT KEEPS TRANSFORMERS YOUNG? . . .

. . . Obviously, a means of controlling moisture and heat. That's why Kuhlman transformers are thoroughly dried inside and sealed air-tight and moisture-proof outside. Also, why generous ducts are spaced all through the windings to carry off excess heat and assure cool operation.

As an operator, you can get the most out of this built-in life by limiting excessive overloading—working with care and cleanliness around open transformers—and checking the condition of the oil occasionally.



Free movement of oil through the windings carries off heat, eliminates damaging hot spots, keeps the transformer young longer.

DOES CONDITION OF OIL AFFECT TRANSFORMER LIFE?

Perma-Kuhl Oil, used in Kuhlman transformers, is the finest coolant and insulator you can buy. Minimum care keeps it clean and clear.

The best oil, however, will oxidize and form sludge under abnormal operating conditions. Sludge impedes oil circulation, weakens insulation and, finally, will corrode steel. Routine inspections can avoid these harmful effects.*

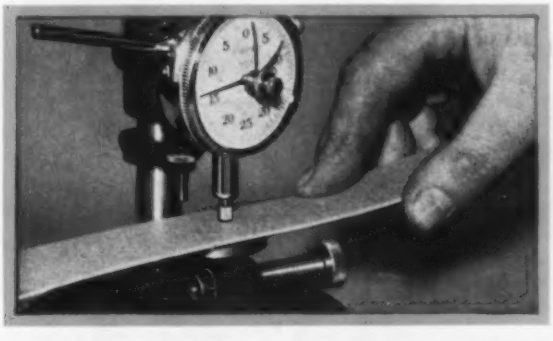
The dielectric strength of oil is accurately determined by laboratory testing.

HOW MANUFACTURING METHODS INCREASE LIFE

Design alone can't guarantee long life. It takes careful manufacturing to build endurance into a transformer.

**For facts on transformer oil behavior, write for "Kuhlman Kurrents," Volume 32, Number 3.*

Special emphasis is put on manufacturing controls at Kuhlman. Connections are tight; winding tensions are held within close ranges; core steel is processed with great care. Countless other rigid standards are observed.

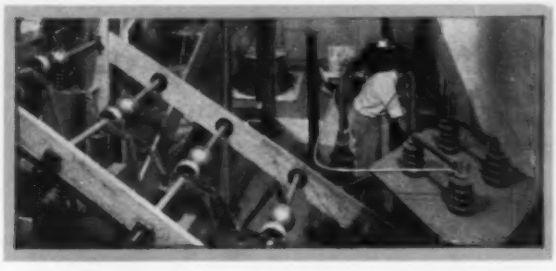


Painstaking checking of insulating material assures quality and accurate dimensions for long service.

The men who build Kuhlman transformers under these manufacturing controls are long in the business, and their skills lengthen the lives of the transformers they build.

HOW IMPULSE TESTING ASSURES LONG LIFE

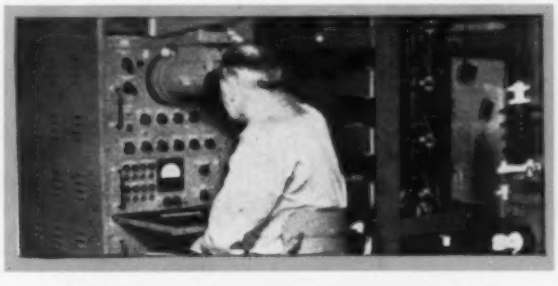
Every Kuhlman design approved for manufacturing and every pole-type transformer approved for shipment must pass the "Impulse Test." This test—which subjects the transformer and all its components to a simulated surge of lightning—gives positive proof of transformer quality.



Design impulse tests in the laboratory establish the quality and the lifetime impulse level of the transformer.

As a design test, it establishes the basic impulse strength of the transformer. This, at Kuhlman, is in excess of NEMA requirements to provide added quality and protection for longer, more useful life.

As a production test, it assures each finished transformer coming off the assembly line is free of defects, has design quality, and is ready for long-term, trouble-free service. Any hidden weakness that might cause trouble—no matter how minor—is quickly detected by these rigorous final tests.



Production line impulse testing assures that each unit coming off the production line meets Kuhlman standards.

Today the big difference in transformers is quality

Whether your job is specifying, ordering, or keeping transformers in service, you'll find Kuhlman quality means longer life, better service, at lower cost.

KUHLMAN DISTRIBUTION TRANSFORMERS

KUHLMAN ELECTRIC COMPANY General Offices: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

A control rod drive housing being rinsed at Fairchild Camera and Instrument Corp. Radiological Decontamination Laboratory, Syosset, L. I., N. Y.

Ion exchange helps save "hot" reactor mechanisms from the nuclear cemetery

When valves, pumps, heat exchangers and other parts used in or with nuclear reactors became sluggish or clogged, they used to be taken out and buried in the ground because they were radioactive . . and replaced by new parts. This ran into money. A single control rod drive mechanism, for example, costs $30,000.

Now radioactive contamination is actually scrubbed off and rinsed away so that parts can be refurbished, reassembled and re-used . . at a fraction of their replacement cost.

Radioactive rags, brushes and cleaning fluids used for decontaminating are put in special containers and disposed of through licensed agencies.

But the problem of what to do with the contaminated rinse water is easily solved at Fairchild by their Permutit Nuclear Purifier. Each refill of 3 cubic feet of Permutit ion exchanger resin in this unit safely decontaminates thousands of gallons of rinse water!

Other nuclear applications where Permutit ion exchange is employed: concentration of uranium from ore, demineralizing reactor coolant water, treatment of radioactive wastes and purification of heavy water.

Permutit's nuclear experience is at your service. Write to the Permutit Company, Dept. EW-10, 50 West 44th Street, New York 36, or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®
rhymes with "computo it"
A DIVISION OF PFAUDLER PERMUTIT INC.
Water Conditioning
Ion Exchange • Industrial Waste Treatment

Slam it closed "blind"...

this cutout never misses!

The lineman doesn't have to steer the fuse tube into the contact of S&C's XS Cutout

If the lineman closes into a *fault* and misses—where is the lineman?

If he closes into a *load* and misses—what can the lineman do?

Even an experienced lineman shouldn't be expected to steer a cutout closed; for safety's sake, he must look away.

For positive steering when closing, the fuse tube of S&C's XS Cutout is controlled in four ways:

(1) The tube trunnion is thrust firmly forward into pockets in the hinge by the contact springs.

(2) The tube trunnion is simultaneously stabilized by the hinge's inner surfaces acting on the vertical faces of the trunnion casting.

(3) At the same time, guide edges of the hinge steady the corresponding edges of the lifting eye in the tube trunnion casting.

(4) LOADBUSTER® attachment hooks act as guides to steer the fuse tube as it "wipes in" and seats positively.

These four elements provide certain closing action, even when slammed home blind. And on dark and windy nights, closing is a sure thing, without hang-ups or damage.

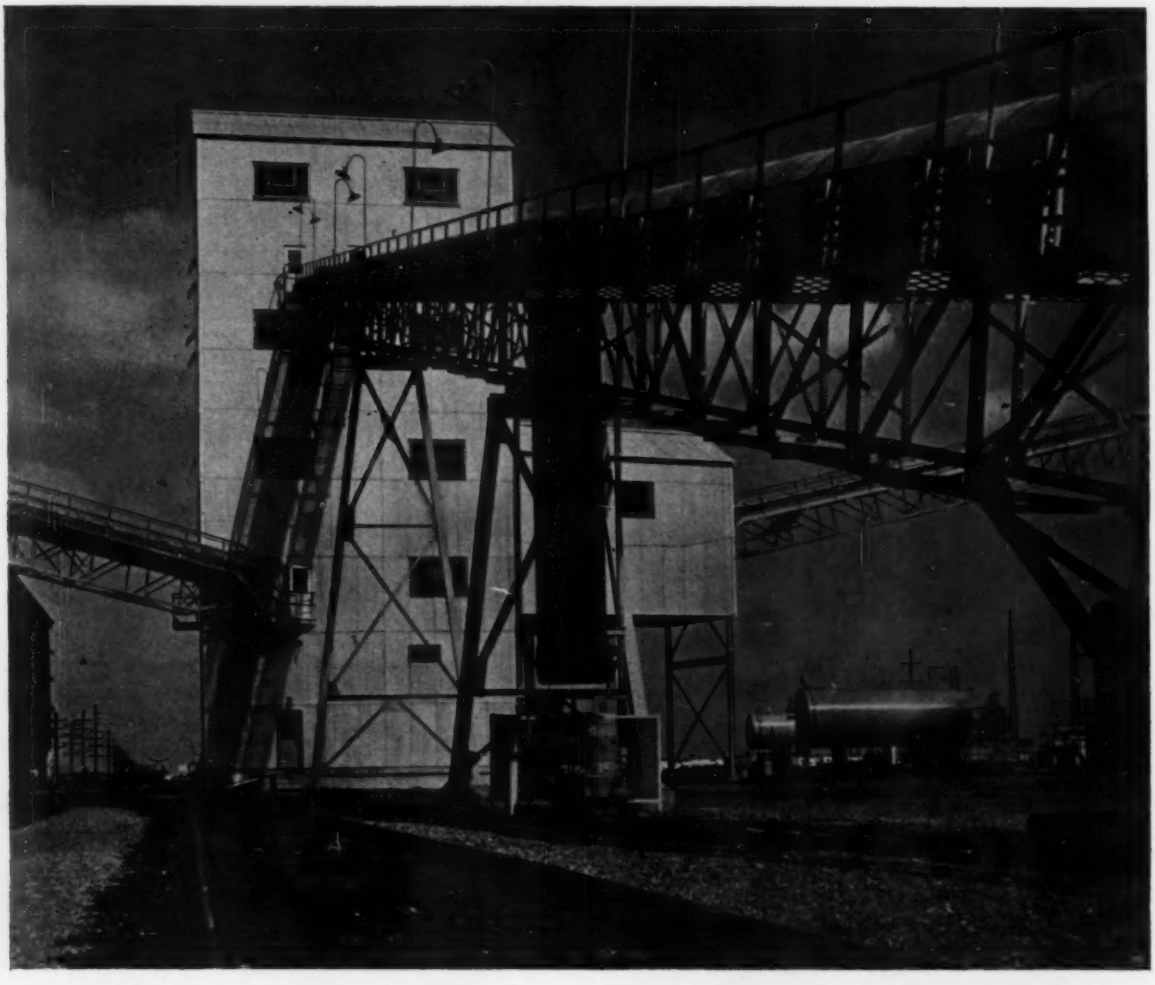
For full information about the XS Cutout and its use with LOADBUSTER for load switching, write for Bulletin 511 to S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

S&C

DISTRIBUTION CUTOUTS

Disconnects • Cutouts • LOADBUSTER® • Interrupters
Metalclad Switchgear • Fuse Links • Power Fuses

US RUBBER CONVEYOR BELTS



Big Eastern utility relies on dependability of "U.S." Belts

Rather than incur the expense of standby equipment, the plant officials decided to depend on U.S. Rubber Conveyor Belts. Their decision was based on the "U. S." record for durability and low maintenance.

Long Island Lighting Company, serving one of the fastest growing communities in the country, has planned to be ready for the tremendous increase in power needs—as far as thirty years from now. In their newest power station, the conveyor system is built to handle more than three times its present daily load of coal.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

US RUBBER **Mechanical Goods Division**

United States Rubber

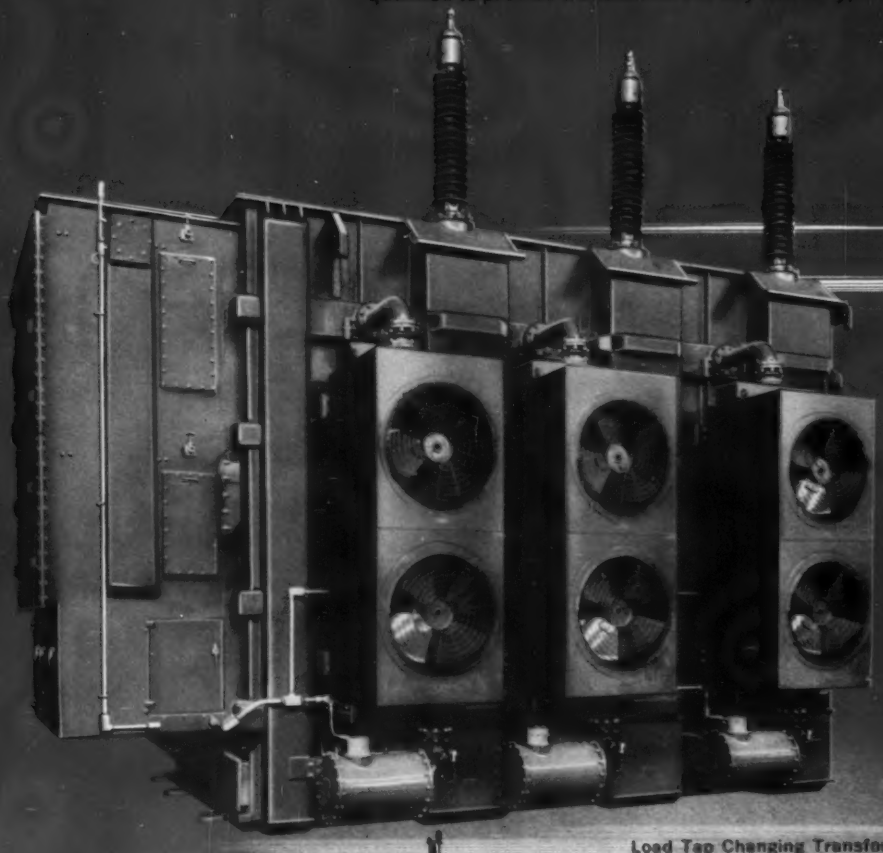
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

MOLONEY TRANSFORMERS . . . EVERY TYPE AND SIZE NEEDED FOR THE TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER

Moloney Electric manufactures a complete line of transformers from the large generating station transformers rated in the hundreds of thousands of KVA to the small pole type distribution transformers.

With a background of more than sixty years in the development, design and manufacture of transformers, Moloney Electric Company is well qualified to provide transformers of any size or type that may be needed.



Load Tap Changing Transformers. A combination of Power Transformer and Automatic Load Tap Changing Equipment.

MOLONEY ELECTRIC®

Bulletin No. G-58

MOLONEY ELECTRIC

Moloney's extensive research and development programs provide answers to many of their customers' operating problems and enable Moloney to design and build each type of unit to give the best possible performance with a minimum of maintenance.

Whatever your transformer requirement Moloney can build a transformer to do the job efficiently and economically. Specify Moloney Transformers.

A Power Transformers. Available in any Kva and voltage rating in both standard and special designs.

B Regulating Transformers and Feeder Voltage Regulators to provide constant line voltage for all transmission and feeder lines.

C Articulated Primary Unit Substation for outdoor installations. Consists of an incoming high voltage section, an outgoing low voltage section and a transformer section with or without Automatic Load Tap Changing Equipment.

D Ventilated Dry-Type Secondary Unit Substation Transformers (Group 2 Insulation). Suitable for indoor installations.

E Integral Primary Unit Substations. A package unit for outdoor installations, incorporating an incoming high voltage section, a secondary circuit breaker and a Power Transformer with Automatic Load Tap Changing Equipment.

F Oil or Askarel-Immersed Secondary Unit Substation Transformers.

G Nitrogen-Sealed Dry-Type Secondary Unit Substation Transformers (Group 3 Insulation). Suitable for outdoor or indoor installation.

H Integrated Substation. Includes an incoming high voltage section, transformer section with or without LTC equipment and an outgoing low voltage section. Available in either single or double circuit construction.

I Subway and Vault Type Network Transformers either oil or askarel immersed.

J Subway Transformers. For locations where protection against submersion is required.

K Substation Transformers.

L Single-Phase Pole-Type Step Voltage Regulators. Self-contained and completely automatic. Equipped with Moloney's "Select-Amp" allowing the range of voltage regulation to be adjusted from a maximum of plus or minus 10% to a minimum of plus or minus 5%.

M Type DWH Dry-Type Transformers 1½ through 15 Kva. 600 volts and below. For indoor or outdoor installation.

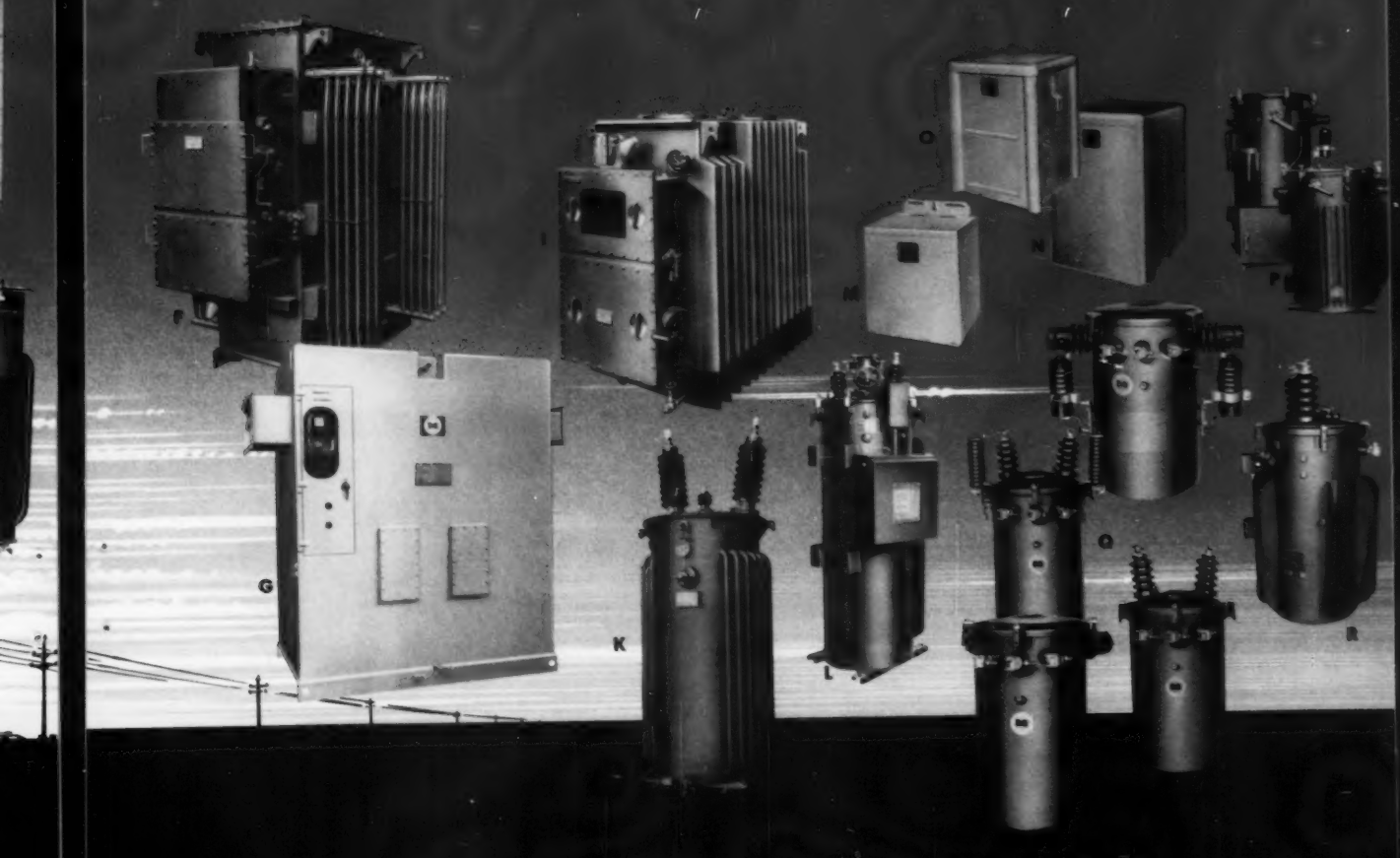
N Type DWH Dry-Type Transformers 25 through 50 Kva. 600 volts and below. For outdoor or indoor installation.

O Type DVB Dry-Type Transformers 25 through 50 Kva. 600 volts and below. For indoor installation.

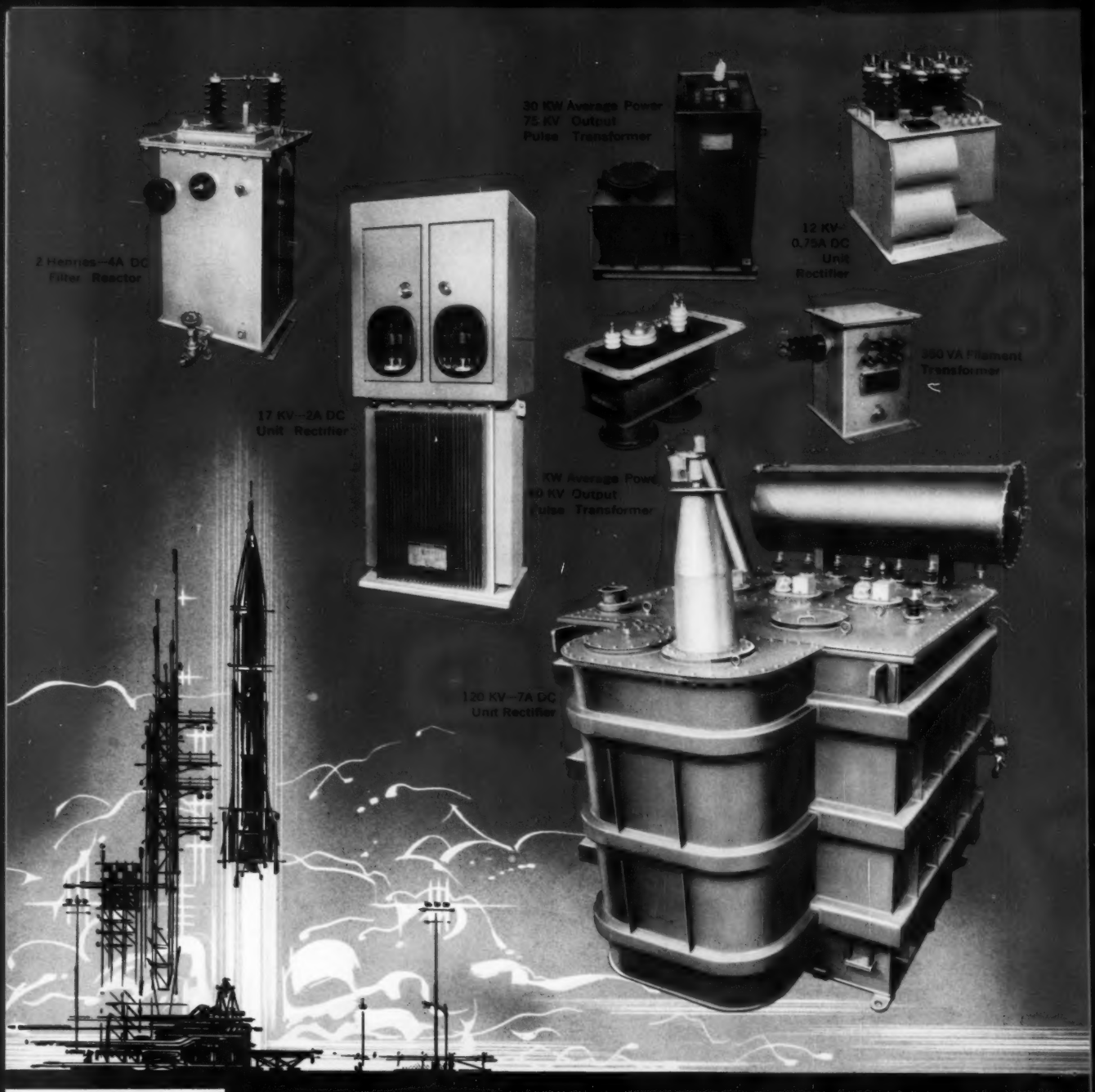
P Constant Current Transformers are available in both Conventional and Packaged Unit Types.

Q Conventional and CSP Single Phase or Three Phase Pole Type Distribution Transformers.

R Pole Type Distribution Transformers available in sizes up to 167 KVA, 18 KV. Equipped with an externally operable high voltage switch suitable for changing the connection of the high voltage winding from multiple to series.



. . . . . ALL ALONG THE LINE . . . . . .



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Editorial Comment

OCTOBER 6, 1958

Is Modernization Needed for Power Plants?

The best target for modernization within the framework of today's power plants are the older stations—the worst wasters of manpower and space. But the key to future economies will depend on efficient operation—in the new as well as the older generating stations.

At first glance there are factors that would appear to discount the advantages of modernizing generating equipment in many instances. These factors include: The need for peaking capacity, resulting in use of the older, high-operating cost generating equipment; the high cost of modernization; and the relatively high degree of automatic control already prevalent in existing power plants.

Today, however, additional factors are coming into view that may change the picture as far as modernization of power plants is concerned.

Availability of sites is one of the most critical problems facing the utility industry. One method of obtaining suitable sites is the redevelopment or modernization of existing sites. Many utilities already have used this approach. Besides increasing the capacity available from a well-situated site, this approach has the advantages of eliminating high-cost generation.

The advent of summer peaks on many systems have increased the duration and amplitude of annual peaks. There is every reason to believe that this characteristic of load will grow rather than decline. If this is the case, the extremely high operating cost of the older units used for peaking will become more important in relation to capital expenditures required for modernization.

Under present operating conditions and availability of operating manpower, the degree of automation in the generating plants is probably adequate. But will it be adequate for the future? For one thing, older plants will probably operate for longer periods of time, as indicated above. This alone would tend to suggest modernization of controls in these plants. But in addition to this the utility industry must make more efficient use of available manpower. And this can only be accomplished by modernizing older facilities.

Thus the possible changing character in utility loads and the future demands on available manpower within the utility industry behooves us to examine closely the benefits of modernization. Our penetrating report begins on page 71.

Electrade—A Name for A New Program

A formal recommendation that the electrical industry set up a clearing house for the mutual use of digital computer programs has been made by Westinghouse Electric Corp. This recommendation follows the company's offer to share computer programs for solution of power system problems. These actions should encourage others to join in the formation of a program that will bring greater use of available programs and eliminate duplication of programming.

A number of names for the clearing house program have been suggested. But one more than any other embodies the concept of mutual trading of computer programs to eliminate time and effort, and identifies it with the electrical industry. The name is ELECTRADE. It stands for Electrical Companies Trading of Results to Avoid Duplication of Effort.

While the name itself isn't as important as the creation of the program, a suitable name will go a long way in stimulating the very formation of such a program. In the end, a clearing house for programs, by whatever name, will foster and promote digital computer solution of power system problems.

FPC Defends 50-year Licenses for

More comprehensive river development obtained by granting new 50-year licenses for existing but unlicensed projects, FPC maintains. Critics say it violates Power Act

Can the Federal Power Commission grant a new 50-year license for an existing, but previously unlicensed, hydro power project?

FPC Chairman Jerome Kuykendall and General Counsel Willard Gatchell claim that the issuance of a new license for the old dam is both legal and desirable, if a "major new project"—hydraulically integrated with the old dam—is included in the license. This procedure of issuing a single license to cover several existing and proposed projects may lead to the "best comprehensive development" of that stretch of the river, and thereby comply with the principal purpose of the Federal Power Act, they point out.

Not so, say critics of the practice, including Sen. Wayne Morse of Oregon and the American Public Power Association. They charge that when the FPC grants a 50-year license to any dam, which has gone unlicensed for, perhaps, nearly that same length of time, the commission has effectively doubled the length of the license in violation of the Federal Power Act.

Public power advocates also see the practice as a means of bypassing the 50-year termination date of private licenses, when the federal government might exercise its right to take over the dam.

Behind-Scenes Complaints

The issues were aired in a legally-complicated hearing Sept. 25 before the House legislative oversight subcommittee, after several behind-the-scenes complaints had been received from public power supporters. Subcommittee Counsel Francis X. McLaughlin tediously set out the issue with FPC and court precedents, and introduced a 39-page staff report stemming directly from testimony before the Senate Commerce Committee in 1957, when Kuykendall's re-confirmation was being considered.

Specifically, McLaughlin wanted to know why, "in March, 1955, there was an apparent clear-cut change in the (FPC) practice which had been followed for 13 years and which appeared to have been the only practice up to that time concerning previously constructed projects brought under license." He was referring to the FPC order, which granted a single new 50-year license to two subsidiaries of the Aluminum Co of America for three existing unlicensed power dams on the Cheoah River and a proposed new dam (Chilhowee) on the Little Tennessee River in North Carolina and Tennessee.

17 Backdating Cases Cited

McLaughlin cited 17 cases, prior to the Alcoa case, in which the FPC had backdated its newly-issued licenses to existing power projects in conformance with their construction dates. The first of these cases involved New England Power Co's Bellows Falls Plant in Vermont. In this case, the unlicensed dam was given an FPC license, effective Jan. 1, 1938, and backdated to 1920.

Gatchell interjected, however, that the commission has two policies for granting licenses to old dams under its jurisdiction:

1. Licenses granted to old dams, where no additional construction is involved, are issued to conform with the original construction dates, except that all dams built before 1920 are licensed as of 1920 (the date of the Federal Water Power Act); and the effective date of these licenses is not backdated past 1938 (the date of the Federal Power Act.)

2. Licenses granted to old dams—where reconstruction or redevelopment has taken place (or is proposed) or where a major new power project is proposed in coordination with the old dams—may be issued for 50 years from the date of the new construction, if such a license would aid the best comprehensive development of the river.

Gatchell cited seven cases, dating back to 1948, as precedents for the Alcoa decision, where the FPC had granted new 50-year licenses from the date of new construction at older power dams. He insisted that the commission has consistently followed this policy for many years, and denied McLaughlin's contention that each of the seven precedents had "distinguishing factors" from the Alcoa case.

More recent decisions involving new 50-year licenses issued for a proposed project and several existing ones include:

- Montana Power Co in 1956 for one proposed (Cochrane) and eight existing dams on the Madison and Missouri rivers in Montana.
- Carolina Power & Light Co and Carolina Aluminum Co for one proposed (Tuckertown) and five existing dams on the Yadkin-Pedee River in North Carolina in 1958.
- Duke Power Co for one proposed (Cowan's Ford) and ten existing power dams on the Catawba and Wateree rivers in North and South Carolina in 1958.

'Windfall' Alleged

In the case of the license granted to Montana Power Co, McLaughlin also pointed to an alleged $359,983 "windfall" to the company, because administration fees—chargeable against power dams for payment to the FPC—did not have to be paid at one of the existing dams (Morony) until the effective date of the single 50-year license.

McLaughlin further hit the FPC policy as having the "effect of rewarding those project owners who for one reason or another failed to file an application in the past by putting them in a better position than those who complied with the law." Kuykendall agreed that he objects to this effect of the commission's licensing policy, but "there are other ramifications," he pointed out.

The FPC chairman said that many companies would be willing to get new 50-year licenses for old, unlicensed dams in conjunction with

Hydro Dams

new projects, while they might fight extended court battles against the commission's authority to license the old dams at all, if separate licenses were to be backdated to the original construction dates. A license "is not a punitive measure," Gatchell emphasized, and if the commission can obtain better comprehensive river development with its present licensing policy, then it should be continued.

Kuykendall said he would favor the enactment of legislation to improve the commission's licensing procedures—especially in light of the approaching termination dates of many hydro dams—however, he doubted if such legislation could be drafted. He pointed out that the FPC had tried to write new regulations in 1954 concerning the licensing period for hydro dams, but the effort failed (R-139). The commission and the various power companies agreed that each project would have to be considered individually, he pointed out.

Kuykendall did urge Congress to give the commission more funds to hire more staff personnel, so that additional studies could be undertaken to bring unlicensed dams under license. "The companies are fortified to stay out of license because of a lack of FPC funds," he added.

HEARING PRINCIPALS, left to right, are Willard W. Gatchell, Jerome K. Kuykendall, Francis X. McLaughlin and Sen Oren Harris, chairman of the committee

One of the biggest headaches facing the commission today is what will happen in 1970, when the termination date for many hydro dam licenses is reached, according to Kuykendall. He feels that the Federal Power Act clearly permits the FPC to issue new 50-year licenses for dams, where federal take-over is not in the public interest.

Gatchell pointed out that a recent FPC study—using a "typical" $17,750,000 hydro project with only $8-million depreciated when the license expires—would indicate that the payment of severance damages to the power company may keep the federal government from taking it over in the public interest. Since most dams are now used for peaking service only, the cost per unit of power would be too exorbitant to reimburse the companies to build equivalent facilities, he said.

Kennedy Opposes Cut in REA Interest Rate

Rural electric cooperatives can count on the continued support of presidential hopeful Sen John F. Kennedy (D-Mass.) if he reaches the White House in 1960.

Speaking before a Region I (North Carolina to Maine) meeting of the National Rural Electric Cooperative Assn last week in Burlington, Vt., Kennedy made clear his own support of REA, despite the fact that his home state has never allowed the co-ops to operate within its boundaries. Taking a kind of regional-national approach, the youthful-looking Boston Democrat maintained that the REA program has been a benefit to the country as a whole.

"When any farmer in the United States is forced to pay more for the operation of his farm, when it costs more for him to use electrical equipment, then he has less money to buy the shirts and shoes which we manufacture—and less inclination to buy the electrical appliances which we produce. 'The rising tide lifts all ships'—and as Senator from Massachusetts, as well as United States Senator, I intend to keep on working to strengthen the REA program and protect it against weakening attacks."

Kennedy then went on to some of the controversial facets of REA such as the Agriculture Secretary Benson's ruling requiring Department approval on loan applications of $500,000 and over and REA participation in nuclear power programs. But Kennedy concentrated his fire on the REA low-cost money. Said he:

"Let me discuss in particular this problem of assuring for the indefinite future an additional source of loan funds at a low cost to your systems. For this is one of the most essential needs for the future development of rural electrification—and it is also one of the areas under the most vigorous attack today.

"There are two methods of attack on this part of the program. One method is to increase government interest rates to a point so high as

to either make future financing and expansion undesirable or to make the cost of the program to its consumers inefficient. Another method is to cut off your supply of government loan funds completely and require you to obtain credit from private money markets . . .

"I am unable to understand those opponents of REA who are pushing this attack in the name of a sound banking theory. We were interested in having the farms of America serviced with electricity, in making first-class, 20th-century American citizens out of our rural population. The only basic question was: What kind of program was necessary to accomplish this result? Had it required an interest rate of 1% to fulfill our objective, we would have provided for an interest rate of 1% . . .

"We cannot now tell our rural electric systems and their customers that in the future power will be furnished only where it is economically sound to do so under present high interest rates."

Speaking before the same group Vermont's Senator George D. Aiken praised REA for ". . . topping all government agencies in the good it has done for the people." Aiken, a Republican, complimented the REA managers and directors for being part of a program that has "taken skim-milk territory and made it over into investment territory."

States Split on Relocation Payment Rulings

A bill that would have provided utilities with reimbursement for road construction relocations has been declared unconstitutional by the Tennessee Supreme Court. The decision reversed an earlier finding by a county chancellor.

As passed by the 1957 legislature the bill would have required the state to pay utilities for relocations on the federal-aid roads and on other roads in "hardship" cases.

The Supreme Court's ruling is a victory for W. M. Leech, state highway commissioner, who said after the bill passed that he would not pay for utility relocations unless ordered to by the courts or by the state attorney general.

Constitutionality of a 1957 Florida law permitting state reimbursement of utilities for relocation costs necessitated by interstate highway construction was upheld recently in an opinion by state Attorney General Richard Ervin.

Although the law allows the state to pay the entire cost of relocating utilities on interstate projects, it provides that the utilities themselves shall bear the expense on other types of highway projects.

Utilities in the state of Washington have opened a campaign to permit use of public funds to relocate their facilities affected by the state's highway-improvement plan.

Existing state law permits payment of relocation costs for municipally-owned utilities, but compensation for private utilities is not authorized. Private utilities will ask the legislature to amend the law, asserting that higher rates may be necessary if they must pay all relocation costs.

SPEED-UP OF ROAD CONSTRUCTION posed this obstacle in Pittsburgh suburb. While utility's crews repaired storm damage, road crews paved around pole

Friendly Suit in North Dakota

The constitutionality of North Dakota's reimbursement law may be cleared up soon in a friendly suit brought by Northwestern Bell Telephone Co. The company asked for a declaratory judgment setting out the rights of the parties.

Utilities in Washington state have launched a campaign for enactment of a reimbursement law. The state has already agreed to pay for relocation costs of municipally owned utilities in Seattle and Tacoma. The campaign backers contend that public funds should be used for all utilities.

The cabinet of Cleveland Mayor Anthony Celebrezze is split on whether road-building funds should be used to pay for relocating utility installations.

Utilities Director Bronis J. Klementowicz, in direct opposition to Mayor Celebrezze and Law Director Ralph Locher, believes that highway funds should be used to reimburse costs of relocating underground facilities. He feels, however, that the utilities should bear the cost of moving overhead lines.

Outage Averted By Quick Pole Work . . .

On Duct-Line Sling for Kansas City P&L

Quick action by Kansas City Power & Light Co maintenance crews averted a serious disruption of service in downtown Kansas City on Sept. 19. A duct line, carrying six 13-kv cables, was undermined by a break in a 72-in. sewer line 50 ft below the street.

Five poles were placed horizontally across the 20 x 30 x 45-ft deep hole. A sling was suspended from the poles to support the duct line and prevent its falling into the hole. Service on two of the cables was maintained as workmen sparred for time to splice around the trouble spot. When the splicing was done, most of the load was carried on seven other 13-kv feeders. Repair took 24 hr and 50-man peak force.

The mammoth cave-in started in a sewer manhole into which a number of sewer lines emptied. The bottom drain was choked by the initial cave-in, causing sewage to rise and promoting additional caving, until it widened and undermined the adjacent duct line. Two temporary poles carried emergency power to the brewery across a switch track.

U. S. Power Picture

- Rocky Mountain utilities plan coordinated growth
- PUD set for dam bonus

An ambitious $2.5-billion expansion is underway by five of the largest Rocky Mountain area electric utility companies. The program will up the companies' generating capacity from 2.5-million kw to 9.5-million kw by the end of 1975.

Power output from Colorado River hydro dams has been factored into the planning of the utilities. They will "schedule their new generating capacity to coordinate with the 'in-service' dates" of the federal dams, said E. M. Naughton, Utah Power & Light Co president.

Commented J. K. Cummings, regional supervisor of power of the Bureau of Reclamation at Salt Lake City: "There have been no concrete steps taken yet to effect this coordination . . . The Federal Power Commission has made a power market study to determine the needs of the region. When this study is available I'm sure things will begin to head up. Certainly it's going to require coordination to effect efficient utilization of available power."

Tie Lines May Be 230 Kv

The five-state electric systems of the program participants will be interconnected, probably at voltages in the 230-kv range.

These plans were announced by Naughton at a meeting in Salt Lake City attended by top officials of Arizona Public Service Co, Public Service Co of New Mexico and Pacific Power & Light Co's Wyoming division, Naughton, the spokesman, said the approximately 1-million kw output from the Glen Canyon and Flaming Gorge hydro projects would begin coming on the line in 1963.

"In the meantime, the electric companies will continue to build generating plants to supply adequate electricity for all the region's needs."

Large and efficient steam plants will be built to utilize the area's rich reserves of fossil fuels, includ-

(*Continued on page* 69)

People Key to Growth, PEA Is Told

Drumm, Gros, McSparran tell delegates that users must be kept informed of all developments in the power industry

"The progress of the power industry rests on people," Streuby L. Drumm, president, West Penn Power Co, told the 51st annual convention of the Pennsylvania Electric Association, Sept. 17-18, Pittsburgh. Drumm told 600 delegates that maintaining customer support in the face of current problems is the major task confronting utilities today.

Cites Joint Interests

"The combination of methods improvement and harder-hitting marketing programs can work together not only to maintain reasonable rates but also to improve earnings and to benefit employees as well. For the good of all three—customer, owner, and employee—we must work everlastingly toward these goals," Drumm said.

Robert R. Gros, vice president, Pacific Gas & Electric Co, warned PEA members, "If we don't do something about this situation of public opinion now, our industry as we know it today cannot survive more than two generations—three at the most." He urged executives to give their public relations men authority equal to their responsibility.

"Once the PR man has proved his expertness, his advice ought to be heeded instead of being sidetracked for the horseback opinion of the engineers, lawyers and auditors—each of whom may possess top-flight competency in his own field, without necessarily knowing a thing about public relations," Gros stated.

The view of the power industry through the eyes of the farmer was presented by J. Collins McSparran, master, Pennsylvania State Grange. Although emphasizing the excellent service given Pennsylvania farm families, McSparran explained, "There are some companies operating in Pennsylvania today who are doing harm to the entire electric industry by their failure to recognize that the old system of selling electric energy under rates based on demand is as antiquated as the horse-drawn plow. I don't blame farmers and home owners for getting angry when they discover that the current they use to run some piece of equipment costs them from 10 to 30% more than it costs a neighbor, simply because they have tried to use your product in more places around their homes and farms."

Mark W. Cresap, Jr., president, Westinghouse Electric Corp, disclosed some of the challenging aspects of technical change which may be closer than is thought possible. He cited future developments in thermoelectric and nuclear power fields as stimulating rapid growth in the power industry.

"This is no time to be timid," Cresap said. "We know that a change is coming . . . more and more families are being created, more and more children are coming along, greater and greater markets are in the making." He urged the industry to support planned programs to generate change, and "to keep it moving in the direction we want it to go."

Members elected A. D. Root, vice president of Pennsylvania P & L Co, president of the association for the coming year. Assisting him as vice presidents will be W. J. Lyman, Duquesne Light Co; G. R. Parry, Metropolitan Edison Co; and P. R. Lawson, Pennsylvania Electric Co.

Awards Made

Metropolitan Edison Co was awarded a bronze plaque for achieving the best results in accident prevention with a 0.733 frequency. Met Ed's 50.4% improvement in safety performance was the best among the association's larger members. Duquesne Light Co received awards for elimination of disabling electric shock or burn accidents and over two million man-hours worked consecutively without a disabling accident. Also honored were Pennsylvania Electric Co, Pennsylvania Power & Light Co, Home Electric Co, Luzerne Electric & Gas Division (UGI), and Cumberland Valley Electric Co.

NEED TO SATISFY customers was stressed by Streuby L. Drumm, addressing 600 PEA delegates. People, power, and progress was theme of 51st annual meeting

(*Continued from page 67*)

ing oil shales, and eventually uranium in atomic plants, Naughton said.

In commenting on the meeting, PS of Colorado Pres John E. Loiseau said the output from Glen Canyon and Flaming Gorge available to utility companies will represent less than 10% of their 1975 requirements and can readily be absorbed into their integrated systems.

● Grant County Public Utility District will eat its cake and have it too when power is produced at Priest Rapids and Wanapum dams. The PUD commissioners recently announced availability of an additional 438 Mw, or 36.5% of ultimate capacity from the two projects. PUD's reserve share of power will be under contracts by which the utility can withdraw power as needed.

The PUD now buys 98 Mw from Bonneville Power Administration. It will continue to buy from BPA, as long as the rate is favorable, meanwhile selling its own power to other utilities. About 1971, when no additional power is available from BPA and other public agencies are looking to higher-cost steam and atom sources, the PUD will be able to withdraw some 140 Mw. The remainder can be withdrawn at intervals up to 1982.

● Federal Power Commission Examiner Edward B. Marsh has postponed until Jan. 6 a hearing on 76 electric utilities' tax deductions for contributions to a 1957 Electric Companies Advertising Program series on the public-vs-private power issue. Marsh previously postponed a preliminary conference on the case until Dec. 4, after many attorneys claimed they needed at least 90 more days to prepare their arguments.

● Directors of the Nevada Irrigation District recently approved additional studies of a proposed $52-million power and water production project to be undertaken in cooperation with Pacific Gas & Electric Co. The program would give the irrigation district an additional 55,000 kw, while PG&E would boost production by 39,000 kw.

Helene Hits Carolina P&L Coast Area

Hurricane Helene, worst storm in the history of Wilmington, N. C., caused $50,000 to $100,000 damage to Carolina Power & Light Co's system along the Atlantic coast. Wind velocity from 80 to 135 mph caused outages on 22 and 12-kv distribution systems. At one time, all primaries in Wilmington, Jacksonville, and Morehead were out due to automatic opening of associated breakers. Substation ties held, despite a few cases of 110-kv supply line trouble. CP&L's microwave system remained intact, while other communications failed.

Rates and Regulation

• California utilities urge tax normalization approval

In the first of at least three public hearings, utility company spokesmen told the California Public Utilities Commission that new plant construction will be hampered and expected effects of liberalized tax laws nullified unless tax normalization is approved in rate setting.

The PUC initiated the hearings to determine proper treatment of accelerated depreciation and accelerated amortization as they effect rates. Public utilities, common carrier transportation firms, and air transportation companies subject to PUC regulation are respondents.

Some utilities have petitioned the PUC for authorization to normalize the amount of federal income taxes paid in presenting data for rate fixing purposes, while taking accelerated depreciation for federal income tax purposes; in effect, to charge as an expense federal income tax computed under normal, straight-line depreciation. Such deferred taxes could be put into a reserve fund to provide for future tax payments, and could be used for new facilities, which would reduce amounts of money to be borrowed, utility witnesses said.

E. R. Peterson, Southern California Edison Co vice president, said if his company isn't allowed to use the normalization approach, it cannot afford to take the accelerated depreciation benefits of the law.

Opponents of normalization, led by the state attorney general's office, contend benefits to the utilities should be passed on to consumers through lower rates.

In most previous decisions, the PUC has set rates on the basis of normal straight-line depreciation and federal taxes actually paid. However it has permitted normalization of taxes for accelerated amortization, since facilities must be fully amortized in five years and no further depreciation can be claimed on it for federal income tax purposes.

System Briefs

- Summer rain-making effort fizzles, says Seattle City Light
- REA approves $14-million in loans for Alaska projects

As normal September rain began to fall, Seattle City Light acknowledged failure in its program to increase summer rainfall in the Skagit River area above the city's hydro dams.

Water Resources Development Corp of Denver, Colo., was retained last spring for $24,700 to seed clouds with silver-iodide particles. Average rainfall for this summer was 2.8-in. compared with a normal fall of 6.9-in.

City Light wanted the extra rain, after a light snowfall last winter, to fill reservoirs in preparation for fall and winter peaks. The same weather conditions that cut rainfall also reduced power consumption, however, so normal streamflow was sufficient to meet most of the demand without too much of a drain on the reservoirs. Normal precipitation this fall should soon fill the reservoirs, City Light officials believe.

• Approval of REA loans totaling over $14 million has provided a go-ahead for three cooperatives' system improvements and a hydro project. A $12,230,000 loan was approved for Chugach Electric Assn to build the Cooper Lake project, which will have an ultimate capacity of 30,000 kw, and connecting transmission lines to Anchorage. Homer Electric Assn received authorization for a loan of $1,085,000 for a tie line to Cooper Lake. Matanuska Electric Assn was granted a $988,000 loan for distribution lines and system improvements.

• Southern California Edison Co revealed recently that it plans construction of an experimental seawater conversion plant to determine the economic feasibility of several processes. The pilot plant will be built adjacent to the company's Mandalay Steam Station.

Interest will be primarily devoted to a study of the utilization of heat remaining in final turbine stages after partially spent steam is drawn off. The remaining heat might be used to evaporate sea water in order to produce potable water.

HYDRO: Plants on Tennessee's Cumberland River produced 2.3-billion kwhr during the year ending June 30. The record output was 54% greater than the previous high in '57. Power revenues of about $7,181,000 will go to U. S. via Southeastern Power Administration, which disburses the power to TVA.

Apparent low bid for the second Ft. Peck plant was $4,624,100 (government estimate was $8,263,295) made by Chicago Bridge & Iron Co, Salt Lake City . . . Cherry Powerhouse, last major step in San Francisco's Hetch Hetchy system, will be built jointly by four of the city's construction firms whose low bid of $5,230,174 was almost $1 million below estimated cost . . . Shawinigan Water & Power Co's Beaumont plant was dedicated Sept. 24.

International Currents

- Costa Rica president springs a nationalization surprise

An uneasy quietness still hangs over Costa Rica following President Mario Echandi's promise that he would take steps to nationalize American & Foreign Power Co's electric installation in the country.

Echandi, supposedly conservate and private enterprise minded, amazed observers in mid-September by his promise before a communist-led group of demonstrators. He told them he had spoken with the management of National Co for Power & Light, the A&FP subsidiary, about the purchase, which would be handled through the ICE (Costa Rica's nationalized power organization).

He addressed the crowd in company with two acknowledged communist leaders, Manuel Mora and Victor Cordere. They vehemently denounced the American-owned company and U. S. investments in Costa Rica.

According to officials of National P&L, the company has a signed agreement extending until 1966 to supply power to Costa Rica on the basis of a 10% return on the company's investment. Costa Rica has exercised strict control of rates, which are among the lowest in the western hemisphere.

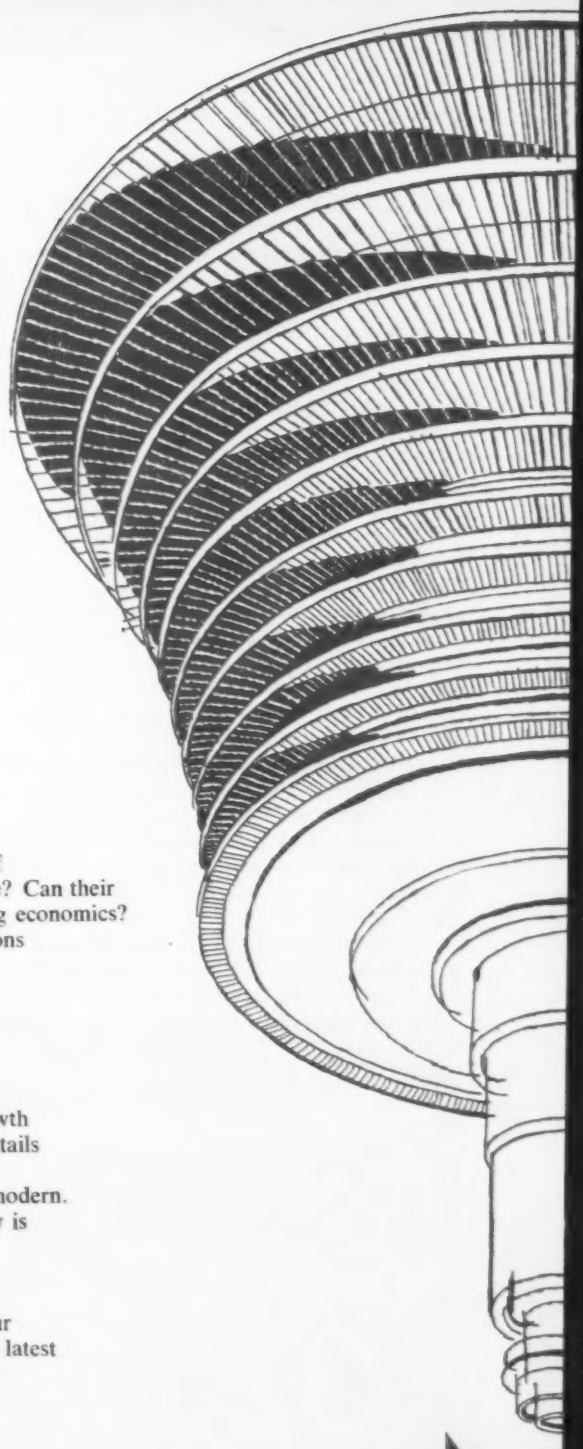
The contract provides that the government can purchase the local company facilities at any time, giving two years notice, at a price based on replacement value. Echandi did not mention this nor did he mention where Costa Rica would raise the necessary purchase funds, which the contract stipulates must be in dollars.

Two points concern both American Embassy officials and foreign investors—present and potential: First, the apparent influence that communist elements have been able to impose on the supposedly conservative Echandi. Secondly, the obvious industrial nationalization intent of the present Costa Rica administration, which most observers thought would halt with Echandi taking office.

ENGLAND: Trials are underway on the submarine link between France and England. The tests will check technique of laying of two cables simultaneously at 108-114 ft depth with at least a 10-ft spacing. The English Channel cables eventually will be 30.4 mi long. They will be single-core type, carrying up to 800 amp in both directions at 200 kv dc. The $12.6-million project is expected to save $560,000 for England and $280,000 for France on exchanges during peaks.

ITALY: To meet an estimated 75-billion kwhr demand by 1965, Italy's electrical industry has a 16-billion kwhr construction program underway to be completed by 1960. Thermal plants, which last year produced 25% of a 42.7-billion kwhr output, will play a large role. Economic limits of thermal production, though, will be reached by the 1960-65 period. This has stimulated nuclear thinking; four atom plants with combined capacity of 618 Mw will be in operation by 1963.

PLAN '59 *Modernize now for growth and profits*



Modernize Generation To Cut Costs

JOHN J. KEARNEY, Assistant Managing Technical Editor

How modern are your generating stations? Will they be capable of economically supplying their share of electrical loads of the future? Can their performance be improved within the bounds of good engineering economics? Electrical World has attempted to help you answer these questions in the following 19 pages of articles on modernization of utility power facilities.

Modernization is of course a regular part of any efficient company's policy. But as you will see by reading the first article in this series it has taken on an added importance.

Conditions for growth are far different from those that prevailed in the years 1947 to 1957. Today capacity is ample. Future growth and profit will depend on the ability to hold down costs. This entails efficient operation in not only the new but also the old plants.

Generally speaking most of our electric production capacity is modern. The majority of it has been built in the last 20 yrs. Yet capacity is steadily being retired. The reasons for these retirements are discussed in the second article in the report.

The third article in the report provides a good bench mark with which to compare how modern your plants are. It is based on our Fifth Steam Station Design Survey and contains a summary of the latest design features of 71 modern steam electric generating units.

Rounding out the report are many examples of how utilities have already modernized their generating facilities.

How Modern Is American Industry ..... p 72

Plant Retirement Rate Steady But May Increase ..... p 76

Results of Design Survey Show Where Older Plants May Be Improved ... p 79

Modernization Opportunities in Power Plants Are Many ..... p 84

PLAN '59

How Modern Is American

THE U.S.A. is starting a new period of economic growth, as we leave behind the recession of 1958. This new period presents a challenge to the nation, to the business community and above all to the individual company—to grow *at a profit*.

By now it is clear that growth is the normal way of life for the U. S. Economy. Since 1947, our national product has been growing at a rate of 3.7% a year. And no recession, even the latest and most publicized, has interrupted the trend for long. Now the economy is growing again.

But the conditions of growth are far different from those that prevailed in the years 1947 to 1957.

Today growth in the economy does not mean pressure on capacity, for most industrial firms. It does not mean easy profits. Rather, this is growth under highly competitive conditions, with profits dependent on a firm's ability to hold down costs. **Is our plant and equipment modern enough to do the job?**

A New Survey

To find the answers to this question, the McGraw-Hill Department of Economics has just completed a special survey of business needs for modernization. **The survey shows that it would cost $95 billion to replace today's obsolete equipment.** And this is a priority job, if business is to get costs down for the years ahead.

This tremendous need for modernization presents a challenge to the U.S.A. as a nation. The Communist powers are making a strong and disciplined effort to demonstrate that they can out-produce us —that they can "plow us under" in a contest of industrial strength.

It is a challenge to American business. Our people expect a continuously rising standard of living. Our workers expect wage increases. And often their demands mean price inflation—unless we can achieve sharp gains in output. The public demands higher national income without inflation. This is the challenge to business as a whole.

It is a challenge to the individual firm. Growth in the economy no longer means an automatic rise in sales and profits for any particular company. There are no shortages; industrial capacity is ample. So to participate in growth, the individual firm must achieve better quality or lower costs than its competitors. Otherwise, there will be no profit in growth and no success story for the company.

Is business prepared today for these challenges? The answer, from our study, is clearly "No". The production and distribution facilities of the U.S.A. are not efficient enough to ensure our continuing superiority over the Communist world, to match every wage increase with higher productivity, to do business in a competitive economy at satisfactory profit to the individual firm.

This statement sounds shocking at a time when much industrial capacity is idle and the recession just behind us is being blamed on a surplus of capital goods. But the facts speak for themselves. Here is the record on the past decade of investment in new plant and equipment, and here is our new study of the job that still remains to be done.

The Modernization Job Ahead: $95 Billion

The McGraw-Hill Department of Economics asked a wide sample of manufacturing companies, and experts in other industries, "What would be the cost to replace all obsolete facilities with the best new plant and equipment?" Here is a summary of the estimates. (Details on next page.)

Manufacturing and Mining	$34.3 Billion
Petroleum Industry	5.3
Transportation and Communications	18.4
ELECTRIC AND GAS UTILITIES	12.0
Finance, Trade and services	25.0
Total: All Business	**$95.0 Billion**

Decade of Expansion[1]

Since 1947, private business in the U.S.A. has invested $291 billion in new plant and equipment. Our manufacturing capacity has increased about 80%; electric power capacity, 145%; capacity for basic raw materials, by 55%. The distribution and service industries have increased floor space by roughly 50% in the decade. In 1957 alone, business spent $37 billion on new plants and equipment—more than the combined expenditure in all of Western Europe plus Canada.

But all of this expenditure has not made our facilities as modern as supposed, or as modern as we need. Of the $291 billion invested by business since 1947, roughly $157 billion has been for expansion of capacity. Only $134 billion has been spent to replace old facilities with better, more modern equipment. And in recent years, this investment has not purchased as much new equipment as the dollar figures suggest, because prices of capital goods have climbed.

Our postwar capital investment has repaired the worst of the obsolescence accumulated during the depression and war years. But huge amounts of old equipment are still in use, as shown by the table on p 73. This is based on a survey of the age of manufacturing capacity in several hundred com-

[1]Figures on "Decade of Expansion" are for the years 1947-1957 inclusive, except where specific reference is made to preliminary data for 1958.

panies, representing all of the major manufacturing industries. Almost 50% of our present capacity was installed before or during World War II. More than 65% was installed before Korea. Expert studies of the major non-manufacturing industries show that the age of equipment, in those industries, is even greater.

Thus, of all business plant and equipment, less than one-third is modern in the sense of "new" since 1950; two-thirds is pre-Korea.

This over-all figure is confirmed by a check on specific industries:

- Nearly two-thirds of our metal-working equipment was installed over 10 years ago, according to preliminary results of AMERICAN MACHINIST'S 1958 census.
- Over 65% of the freight cars on our railroads are more than 10 years old.
- Less than half the capacity to process chemicals, rubber or petroleum is new since 1950—a period that has seen rapid development in such equipment as automatic controls for these process industries.

These examples take on a dollars-and-cents meaning when we recognize that the latest machine tools are about 40% more productive than 1948 models, and that a combination of new freight cars and modern freight yard equipment can reduce operating cost up to 50%. New instruments, that automatically direct the flow of chemical (or other raw material) process, can often reduce processing costs enough to pay back the cost of the instruments in one year. These savings cannot be made in older plants. By using obsolete facilities, our industries accept a waste in labor and materials that totals many billions of dollars per year.

Why Productivity Must Rise

The U.S.A. can ill afford this waste. In the economic struggle between the free world and Communist world, our margin of superiority depends on the efficiency of our productive facilities.

For the growth of our own economy, we shall need a sharp rise in productive efficiency. During the next ten years, American business must provide the goods and services required for a population that will increase by 32 million. And the increased population will expect higher living standards. Furthermore, the population in ten years will include a higher proportion of dependent persons—children and retired people—and a smaller proportion of working age men. Thus, with a relatively smaller labor force, industry must provide more goods for more consumers.

At the same time, industry must strive to hold the line against rising costs. In an economy with a tight labor supply, we cannot count on restraint in wage demands, however desirable such a development might be. In the past ten years, hourly wage rates have increased over 5% per year, nearly

The McGraw-Hill Survey of Modernization Needs
Conducted by the McGraw-Hill Department of Economics in August, 1958

	AGE OF MANUFACTURING CAPACITY (Percent Installed)			COST TO REPLACE OBSOLETE FACILITIES
INDUSTRY:	Prior to Dec. 1945	Dec. 1945 to Dec. 1950	Dec. 1950 to Dec. 1957	Millions of $
Iron and Steel	47%	16%	37%	2,855
Nonferrous Metals	47	13	40	1,022
Machinery	41	21	38	3,224
Electrical Machinery	34	18	48	1,917
Autos, Trucks and Parts	42	11	47	2,204
Transportation Equipment (aircraft, ships, railroad equipment)	59	9	32	854
Other Metalworking	54	17	29	2,351
Chemicals	30	23	47	3,070
Paper and Pulp	49	17	34	2,655
Rubber	46	9	45	600
Stone, Clay and Glass	46	20	34	1,840
Petroleum Refining	45	26	29	1,499
Food and Beverages	58	19	23	3,443
Textiles	59	18	23	1,001
Misc. Manufacturing	51	21	28	6,236
ALL MANUFACTURING [1]	48	19	33	34,771

[1] Includes petroleum refinery companies listed under "petroleum industry" in previous table.

twice as fast as output per manhour. And this disparity may well continue—causing still more inflation—unless we make more rapid gains in productivity.

We can make these rapid gains—if industry goes all out to modernize its equipment. Output per manhour (in manufacturing) has increased only 2.5% per year since 1951. But this compares with gains of 4% a year in 1947-1950, and over 5% in the 1920s. Today the machines and techniques are available for us to equal, or exceed, these records—to raise output per manhour at least 5% per year. This is a job that can, and indeed must be done, to assure growth in the economy without inflation.

The Job Ahead

The dimensions of this opportunity are shown by the table on the previous page. In its survey on the need for modernization, the McGraw-Hill Department of Economics asked a wide sample of manufacturing companies how much it would cost to replace *all* their out-dated facilities with the best new equipment available. The Department also interviewed experts in each of the non-manufacturing industries, to find answers to this question. The answers add up to a staggering bill for new plant and equipment.

Modernization of over-age facilities—replacing only what is really obsolete, by today's production standards—would require a total capital investment of $95 billion, or nearly $20 billion per year for the next 5 years.

Furthermore, new production techniques will soon make *today's* plants obsolete, in many cases. Thus, to keep pace with technical advance *from 1958 on*, will require continuing expenditures of $8 to $10 billion per year for modernization.[1]

The total expenditure to wipe out the backlog of obsolete facilities, and keep up with continuing technical advance between now and 1963, would be at least $135 billion.

The U.S.A. has never spent such a sum on the modernization of industrial facilities. Capital expenditures of boom dimension have, in the past, been associated only with the urgent expansion of capacity. **Some forecasters are now saying that because industrial capacity is adequate, the next few years will be a period of low capital investment. The figures above make clear that this would be a national calamity.** The opportunity is there—and the challenge—to invest record amounts of capital in the modernization of plant and equipment.

A National Problem

This also is a challenge to the U.S.A. as a nation. For 100 years, this nation has been looked to as the model of economic development by the rest of the world. For the first time, we face a serious challenge by another nation and another economic system that claims to be better. In a carefully documented 111 page study released in May, the U. S. State Department declared that "the most serious threat" to the U.S.A. today is the drive for economic supremacy by the Soviet Union.[2] Although a much smaller nation industrially than the U.S.A., the U.S.S.R. is today increasing its national output at a rate of 7% per year and its output per manhour by 4% per year.

The U.S.A. does not have to match these specific figures, which represent the results of forced labor in a country just starting to develop industrially. In the contest to win uncommitted nations, the statistics are not likely to be quoted exactly, in any case. But our over-all growth in national output and living standards must be so impressive as to leave no question of superiority. Our factories must be showplaces of modernization to the foreign visitor that will leave him unable to say "I saw much better" in Britain, or West Germany, or Russia.

This is the challenge to the nation—a political challenge to be sure. But it coincides with the challenge to the business community and the individual firm. And the way to meet it is the same: by thorough and rapid modernization of our plant and equipment—not by the slow and steady pace of recent years, but at an accelerated rate that reflects the greater pressure for output at lower cost.

Obstacles To Be Overcome

We must face up to the fact that real obstacles—both technical and financial—stand in the way of faster modernization. Some companies do not have the technical "know-how" required for the latest production techniques. Many more lack the financial resources. How can we overcome such obstacles, and speed up the replacement of old facilities?

In the course of its study, the Department of Economics obtained comments on these questions from many executives. One of the problems, as we noted above, has been the urgent pressure to expand capacity during most of the postwar period. In giving their attention to this problem, companies have sometimes overlooked the chance to modernize older plants.

In some cases, equipment has been kept in place because it was satisfactory, and the users were not aware of still newer designs. Some equipment users believe that equipment makers are not sufficiently aggressive in designing and demonstrating new models.

The biggest obstacle—and one that presents a persistent problem—is the shortage of funds in many companies that need and want to modernize. For all corporations, the cash flow from retained earnings and depreciation has increased by more than $5 billion from 1953 to 1958. But a number of key industries have failed to keep pace with the general trend. **These include some of the areas where the need for modernization is most urgent: the railroads, large sections of the textile industry, some mining industries and many small to medium-size companies in manufacturing generally.** The problem of these industries and companies has grown more acute in

[1] This estimate is based on technical developments reported by McGraw-Hill editors and current price trends for capital goods. It is consistent with the plans for modernization expenditures in 1958-61 reported by companies in a McGraw-Hill survey conducted in April, 1958.

[2] "The Sino-Soviet Economic Offensive in the Less Developed Countries"—U.S. Department of State, May, 1958.

Modernization Pays

Profits on modernization—like all business profits— have come down since 1955. However, modernization, in contrast to new capacity, still offers a relatively quick return on investment. Here are companies' answers to the question: "In cases where you are actually replacing old facilities with new plant and equipment in 1958—how soon do you expect these replacement expenditures to pay off?"

	PERCENT OF COMPANIES ANSWERING			
INDUSTRY:	**1 to 2 yrs.**	**3 to 5 yrs.**	**6 to 8 yrs.**	**9 yrs. and over**
Iron and Steel	11%	56%	11%	22%
Nonferrous Metals	29	71	0	0
Machinery	12	56	12	20
Electrical Machinery	29	57	7	7
Autos, Trucks and Parts	40	60	0	0
Transportation Equipment (aircraft, ships, railroad equipment)	7	53	20	20
Other Metalworking	38	33	10	19
Chemicals	10	53	21	16
Paper and Pulp	22	22	22	34
Rubber	33	33	34	0
Stone, Clay and Glass	0	57	36	7
Petroleum Refining	16	50	17	17
Food and Beverages	16	44	12	28
Textiles	37	47	5	11
Misc. Manufacturing	9	52	13	26
ALL MANUFACTURING*	18	50	14	18

* Note: Answers to a similar question, in a 1955 McGraw-Hill survey, were as follows: 1-2 years: 17%, 3-5 years: 64%, 6-8 years: 11%, 9 years or more: 8%.

1958—since their profits have declined much more than the average for all business.

Any plan to step up the pace of modernization generally must deal with the special situation in these problem areas. Depressed industries and companies need outside help, if they are to modernize. Such help would include a stronger flow of technical information and advice (and occasionally, venture capital) from the more prosperous, inventive industries—as well as advice from equipment suppliers and distributors, industrial publishers and consultants. There is also a public responsibility to help in the problem areas—not with handouts of government money, but with technical assistance and help in finding private capital (like the efforts now being pursued by the Small Business Administration).

Certainly we should lose no time in reforming those provisions of the federal tax laws that now impede investment in modern equipment by hard-pressed firms—especially the outmoded and unfair restrictions on rates of depreciation for tax purposes. At present, the tax regulations require that depreciation be computed over relatively long periods of "useful life" for most types of equipment. And this is a primary reason for the lag in modernization. Machinery generally becomes obsolete long before the expiration of its "useful life" as specified in tax regulations. But it is difficult for companies—especially small companies—to set aside cash for rapid replacement, unless the full amount to be set aside is exempt from income tax. Canada and most European nations allow more rapid depreciation for tax purposes than does the United States.

A combination of self-help with technical help, and a fair break from the tax laws, would do much to reverse the spreading tide of obsolescence in depressed industries, and in many small companies.

PLAN '59

It is this combination that McGraw-Hill advocates as "PLAN '59", to help business modernize now for growth and profits. This is what it will take to make a start in 1959 on the $95 billion job of modernization, disclosed by the study we have just completed:

1. A better flow of technical information on where and how to modernize business plants and equipment.

2. Careful review by the individual company of its own opportunities to modernize at a profit—then action to replace obsolete facilities.

3. Reform of the tax laws, to allow more realistic deductions for depreciation, and permit more companies to finance adequate modernization programs from this source of funds.

Much of this program is already underway. The 34 McGraw-Hill Publications, and many suppliers and distributors of industrial equipment, have stepped up their information programs to start the modernization drive. Preliminary plans of manufacturing companies show a strong emphasis on capital spending for this purpose. In August, Congress passed a bill providing limited tax relief for small business.

But the real task of modernization still lies ahead. It is the greatest challenge, and the greatest opportunity, confronting American business as we move foward into 1959.

PLAN '59

Plant Retirement Rate Steady

- **Age no longer appears to be the most important factor in retirement plans of the future**
- **Replacement of older units with newer more efficient equipment has been a decided factor in recent retirements**
- **Diesel equipment, on the average, is retired sooner than steam or hydro generating equipment**

Old generating equipment is needed for peaking capacity so that generally there is no economic justification for retiring it. This statement usually dismisses many studies on obsolescence of generating equipment. Yet retirements have run about 3% of capacity addition in any given year for the past decade with the exceptions of 1955 and 1956 when they were slightly higher following the large capacity additions made in 1954 and 1955.

Why have these retirements been made and will they continue at this rate? If they do it will mean a large replacement market, considering the new capacity additions that are forecasted.

A recent EW survey of retirements during the past two years sheds some light on the first part of the question. The survey shows that approximately 500 Mw of capacity of various types and in varying sizes was retired because:

- Operating costs were too high.
- Units were no longer reliable.
- Power produced from the retired units was replaced by transmission line power.

These reasons are, of course, not extraordinary, but a detailed analysis of the survey data shows some interesting trends. As Table I below indicates, almost all of the capacity retired was in steam equipment, but almost half of the units were diesel. Diesel equipment, on the average, was retired sooner than steam or hydro, average retirement age being 25, 36, and 41 years, respectively. High operating cost was the main reason for retiring diesel units. In almost a third of the cases where these units were retired, the retired power was to be replaced by transmitted power. Undoubtedly the small size of the diesel units, and the high cost of fuel oil justify their earlier retirement—early, at least, in comparison with steam and hydro units. Another contributing factor is the fact that municipal and cooperative systems, where diesels are mostly used, are no longer isolated as they were in the past. Such systems can, in many instances, purchase power rather than generate it with their small, high-cost units.

Retirements of Diesels Should Increase

The latest cost figures published by the American Public Power Association (1956 figures) bear this out. They indicate that public power bodies purchased power at an average cost of 4.9 mills per kwhr. The same report shows that the average production cost (capital cost of equipment not included) for a diesel plant was 13.5 mills per kwhr.

There is therefore every reason to believe that the rate of retirement of diesel units will not only continue at the present pace but in all likelihood will be accelerated.

Installation of new diesel capacity however is another matter. There are indications that it and other types of low-cost capacity may be considered by utilities for peaking capacity if the duration and amplitude of peaks increase in the future.

There is approximately 2.5 million kw of installed internal combustion capacity in the United States today.

Table I—Capacity Retirements in Past 24 Months

Type of Unit	No. of Units Retired	Average Size in Kw	Average Age at Retirement	Total Capacity Retired in Kw	Percent of Total Capacity Retired	Percent of No. of Units Retired
Diesel	94	370	25	35,113	6.8	44.5
Hydro	39	425	41	16,555	3.2	18.5
Steam	78	6,000	36	467,140	90.0	37.0
	211			518,808	100.0	100.0

But May Increase

Aside from the relatively large amount of hydroelectric capacity retired in 1956, retirements of this type have been insignificant in the past and will probably remain so in the immediate future.

Operating Costs Big Factor in Hydro

Apparently hydro units are run until their operating cost, a small portion of the total cost of producing power, becomes completely unmanageable. Their older age at retirement is indicative of this. And they are not affected by the rising cost of fuel that has plagued thermal plants and will continue to do so. The hydro plants that have been retired are small. This size unit represents only a very small portion of the installed hydro capacity in this country. In fact, an inspection of the 1956 FPC Study of Hydroelectric Plant Construction and Annual Production Expenses indicates that only about a third of the installed hydro capacity is in plants of 20-Mw capacity or less. These obviously include many units larger than the average size unit of 425 kw, retired in the past two years.

Most large hydro installations were installed in the thirties, so that they are not anywhere near retirement age even were the age of retirement suggested in the survey applicable to the larger units. Thus future retirement of generating capacity should not be affected greatly by hydro electric power plant retirements.

OLD UNITS such as these vertical ones shown here are being retired in expanding utility modernization plans

Steam Retirement Reasons Are Many

The reasons given for retirement of the 78 steam units reported in the survey varied. Although high operating cost was the main one, loss of reliability and use of the site for a new large unit were cited almost as often as reasons for retirement. These reasons, particularly the last one, are borne out in an extensive study based on data prepared by H. E. Roberts, Bureau of Power, Federal Power Commission. This study of steam units, covering the 5-year period 1953 to 1957 inclusive, showed that units retired during this period were about 35 years in age and averaged 4.8 Mw in size.

During the five-year period 351 units, totaling 1,703 Mw in capacity, were retired from 176 plants. Only five units, totaling 216 Mw, were 30 Mw or larger. They included 60 and 51-Mw units at the Crawford station of Commonwealth Edison Co; a 40-Mw unit at American Electric Power Co's Philo plant; the 35-Mw, Huntley No. 1 unit of Niagara Mohawk Power Corp; and a 30-Mw unit at the Tait station of Dayton Power & Light Co. All were re-

Table II—Capacity Classified as to Date of Installation

	No. of Generator Units	Total Mw	Average* Unit Size
Prior to 1910	165	372	2.3
1910 to 1919	853	4,818	5.6
1920 to 1929	1,277	14,422	11.3
1930 thru 1940	587	8,064	13.7
	2,882	27,676	9.6

* The largest unit in 1910 was 12.5 Mw; as of 1920—45 Mw; 1930—207 Mw and 1940—208 Mw.
Source: Directory of Electric Generating Plants—Jan 1941, FPC publication S-9 (now out of print)

moved from well-situated existing plant sites to make space for larger units.

Nineteen retired units were 20 Mw or larger, including those above, and 55 were 10 Mw and larger. The remaining 296 retired units averaged less than 3 Mw.

Many Old Units Still in Service

With this as a background, what can be said about future retirements? It would appear that all small, 35-year-old units can and should be retired. Probably about 2,000 Mw of this type capacity is still in service, as the following analysis indicates.

Table II shows the age of capacity installed up to and including 1940. During the 12-year period, 1941 through 1952, total retirements amounted to approximately 1,500 Mw. An incompleted review and analysis of these retirements by H. E. Roberts indicate that practically all of the retirements were in the 900 plants in service as of January 1941. Thus the January 1958 inventory of units installed before January 1941 would be as shown in Table III. This would indicate that approximately 2,000 Mw installed prior to 1920, all at least 37 years old, has not been retired.

Based on the statistics presented it is reasonable to expect that this 2,000-Mw capacity will soon be retired. It is also reasonable to expect much more than this will be retired in the coming years—perhaps as much as 20-24,000 Mw in the next ten years. The retirements in the 17-year period, 1941 to 1957, are not necessarily indicative of what may be expected in the near future. Most of these retirements were made on the basis of age. But in the future obsolescence and inadequacy, not physical condition, will be the controlling factors.

Average Size of Older Units Is Very Small

Just basing future retirements on the age and size factor, however, shows that the 22,486 Mw installed between 1920 and 1940 should soon be retired. The average size of these units is 12 Mw—a very small size compared to the 1956 average size of 110 Mw. The heat rate of these units is about 13,200 Btu per kwhr. With rising fuel costs this poor heat rate will make the cost of producing power prohibitive, even granting that capital charges are insignificant.

Power production costs for these plants are not readily available, but the figures in the Fourth Survey on Power Costs of the American Public Power Association will adequately prove that these costs are high. These figures indicate that in 1956 average production costs (not including portion for capital) for the plants recorded in the survey was 7.86 mills per kwhr. Average size of these plants was about 40 Mw. Average plant load factor was 50%. Compared with this, modern steam power plant production costs were 3.25 mills per kwhr, according to EW's Tenth Steam Station Cost Survey. This was at an average plant load factor of 69%. The calculated production cost at 50% plant load factor amounts to 4.50 mills per kwhr—still considerably lower than 7.86. Dealing with averages, of course, is sometimes misleading, when the compared figures are relatively close in value. But with the spread of almost two to one the conclusions are fairly accurate.

Summer Peaks Have Effect

These compared figures will become more important in the future for several reasons. For one thing there is nothing in sight that indicates any substantial reduction in fuel costs, the major expense in running these old units. And with the advent of summer peaks these older machines will have to run for longer periods, making operating costs more important in their relationship to capital expenditures for new, more efficient units.

Add to this the fact that operating labor requirements and standby maintenance of these older units, and property taxes paid in most instances, are disproportionately large for the value of the capacity obtained. Thus it is not difficult to forecast a rise in the number of units retired in modernization plans. This is particularly true in metropolitan areas. And it is this type of retirement that will involve a substantial amount of capacity compared with what has been retired in the past 17 years.

Thus age may no longer be the most important factor in retirement plans of the future. That this is so is already evident from the study of the retirements in the past 24 months which indicate that replacement of existing units with newer, more efficient equipment is already being done by several utilities, large and small.

Table III—Inventory of Old Generating Capacity

	No. of Plants	No. of Units	Total Mw	Average Unit Size—Mw
In Service, Jan 1, 1941	900	2,882	27,671	9.6
Less Retirements				
12 yrs (1941–52)	165	750	1,500	2.5
5 yrs (1953–57)	91	351	1,703	4.9
Total Retirements	256	1,101	3,203	
Jan 1, 1958 Remainder (Installed Prior to Jan 1, 1941)	644	1,781	24,468	14.1

PLAN '59

Results of Design Survey Show Where Older Plants May Be Improved

Statistics on 71 modern thermal units also verify continuing trend to larger units with higher steam temperatures and pressures

Electrical World's Fifth Steam Station Design Survey affords an opportunity to examine the latest in modern design.

This examination of 130 details of 71 modern units also shows that some of these advance design items may be useful in a plant modernization program. Some of the more fruitful suggestions include:

1. Modifying units for quick load pickup.
2. Replacing high-operation cost coal handling equipment with modern conveyor systems.
3. Using television to convey operating information.
4. Installing new water treatment equipment.
5. Centralizing control and installing data-logging equipment to reduce operating labor.

More Equipment Will Be Outdoors

In evaluating modern design trends in general it appears that plant designers are relying more on outdoors equipment than they did at the time of our Fourth Steam Station Design Survey two years ago. The accompanying table shows how our present tabulation compares with figures of two and four years ago.

A comparison of the figures for the third and fourth surveys indicates that the trend to an increased use of outdoor equipment appeared to have stopped two years ago. The latest figures show that this trend has not continued. Sixty percent of the boilers and 30% of the turbines will be installed outdoors compared with 34% and 24%, respectively, two years ago. There will be almost twice as many feed pumps installed outdoors and half again as many fans. Dust collectors are the only equipment which will not be located outdoors as often as they were at the time of our last survey.

The fact that unit size, temperature, and pressure are increasing is not, of course, startling. But a few statistics may serve to indicate how extensive these increases have been. Seventy-two percent of these new units will be 100-Mw or larger and about one-third of them 200 Mw or larger. One unit reported will be rated at 500 Mw.

All but 11 of the units will use the reheat steam cycle. Only two will operate at steam pressures less than 1,200 psi and almost half will use 2,000 psi or greater. Four out of five of the larger units will have a superheat temperature of 1,000F. The others will use 1,050F, except one supercritical pressure unit being designed for 1,200F and one subcritical unit for 1,100F operation.

External walls of brick, aluminum, and cement-asbestos were reported on almost an equal basis. This indicates a change from past practice when brick-wall construction usually predominated. Undoubtedly the higher material and labor costs of brick construction have stimulated this trend in plant construction in all areas of the country. Four of reporting utilities indicated that they will use porcelainized metal for external walls; two will use steel; and 12 more than one material.

Forty percent of these new units will be designed for quick load pickup. This is almost twice as many as the number reported in our last survey. Apparently operators are fully aware of the fact that in time most of these units will be subjected to cyclic

Table I—Use of Outdoor Equipment

	3rd Survey (65 plants reported)	4th Survey (67 plants reported)	5th Survey (71 plants reported)
Boiler	31	34	43
Turbine	19	16	21
Fans	43	38	55
Pumps	18	11	18
Air Heaters	30	34	45
Dust Collectors	31	33	29
Circ. Pumps	*	28	36
Air Compressors	*	*	18
Pulverizers	*	*	3
Generators	*	*	26

* not asked on 3rd and 4th survey

Have You Modernized Your Thinking About Power Plant Design?

If you have, your plans for plants probably include consideration of the following progressive measures uncovered in the Fifth Steam Station Design Survey:

- More outdoor equipment
- Smaller coal bunkers
- High steam pressures and temperatures
- Pressurized furnaces
- Demineralizers
- Two strings of heaters
- Condensate bypass demineralizers
- Condenser tubes welded to tube sheet
- Compartmentized hot wells
- Two not three boiler feed pumps per unit
- Cross compound units
- Data loggers
- Heat rate computers

operation and that it is well to prepare for it in the design stages.

Four out of every seven of the new units will have steel stacks. Only two units will have brick stacks, both coal-burning plants. The remaining units will have concrete stacks. And most of these units will burn coal also. Stack height, of course, depends on the fuel burned, plant location, and whether the stack is on ground elevation or on top of the boiler. Heights as low as 30 ft were reported for a gas-fired unit in the west south central region and as high as 500 ft for a coal-fired unit in the east north central. Not many stacks will be over 400 ft. And if the short stacks of gas-fired plants are excluded, the majority of units will have stacks between 200 and 300 ft.

Earthmoving equipment for both piling and reclaiming fuel will be used at all but one coal-burning plant. This plant at a mine mouth plant will use a drag line. About two-thirds of the units using coal will have bowl pulverizers.

Bunkers Have Smaller Capacity

Over the past few years bunker capacities have decreased. Four years ago most coal-burning plants reported in EW's design survey that they were to be equipped with bunkers having a capacity for 30 to 50 hr operation. Two years ago this capacity figure was for 20 to 40-hr operation. In this survey over half of the new plants will have bunkers capacities of 30 hr operation or less.

It is difficult to generalize on this trend because bunker capacity is a function not only of how the plant will be operated but also of the operation of the mines from which it receives coal. But the steady development in coal-handling and conveying equipment that permits operators to fill bunkers readily and the tendency to use the ready coal pile, undoubtedly contribute to the use of smaller bunkers. Of equal importance is the desire to reduce investment costs by making the bunkers only as large as is absolutely necessary. This is particularly true for large units where bunker structural expense is considerable.

A little less than one-quarter of the coal-fired units will use small bunkers with ready coal piles.

Most large units will have divided or twin furnaces, although two units of 300-Mw capacity will have single furnaces. The smallest unit having a divided furnace will be 110 Mw. And the smallest unit having a twin furnace will be rated 240 Mw. Thirty-one of these units will use pressurized furnaces. All but a few will be in the Southwest. And all but three are primarily gas-fired plants.

The spray method will be used as the main means of controlling superheat temperature for most of these new units, burner tilt and damper control being second and third choice. For emergency or secondary superheat control, designers selected spray control in almost all instances. Six utilities reported designing the units with more than one method of primary superheat control.

Reheat temperature control will be achieved in about half of the units with tilting burners. Gas recirculation, spray, and damper controls will be used in the other plants on an almost equal basis. All but three units will be equipped with spray control as the secondary or emergency means of controlling reheat temperature.

Just a little less than half of the units report television facilities. The percentage of units using television has remained about constant in the last three surveys. The most often viewed objects will be drum level and burners. Eleven units will be designed to view more than one object, down slightly from 13 in the last survey. There seems to be no correlation between unit size and television use.

Once-Through Boilers Will Be Used

Almost twice as many of these new units will have forced circulation boilers as those reported in the last survey. All but two of these twenty forced circulation boilers are large. Three once-through type boilers have been reported, two at the Eddystone plant of Philadelphia Electric Co and one at the modernized Tait station of Dayton Power & Light Co.

Straight electrical precipitators will be used more often than combination electrical and mechanical precipatators, but less frequent than straight mechanical precipitators. Location of plant is naturally of paramount concern when specifying precipitators or the type, so that it is impossible to establish any

trend on the basis of the information available in this survey. But information is sufficient to indicate a trend to the use of multi-precipitators. Quite a number of units will have dual precipitators and some as many as four to six precipitators per unit. These extraordinary installations will be for large units. One oil-burning and one gas-fired plant will be equipped with mechanical precipitators.

Source of dc power for the electrical precipitators will be predominantly by electronic rectifiers—75%. Two rotary, two static, and one silicon rectifier are also reported.

Air as a cleaning medium is preferred two to one over steam for soot blowing. All the smaller size units will use steam blowing.

Little Interest in Selling Flyash

About four out of five utilities will dump their fly ash. The others will sell it in bulk. This very poor showing in the number of utilities selling fly ash has prevailed since this question was first asked in EW's survey four years ago.

Demineralizers continue to dominate as the means for purifying feed water. In this survey 50 of the 71 reporting units will have them. The remainder will use evaporators. Half of the units using evaporators are extensions to existing plants. And half of them (not necessarily the same units) are 100 Mw or smaller.

Group bypassing of heaters continues to be used by designers as a means of reducing initial investment in bypass piping and valves. Fifteen units will have both low and high-pressure heaters group bypassed; five will have only the LP heaters group bypassed; and 11 the HP heaters group bypassed.

The trend to provide two strings of heaters continues. Seventeen units will have this arrangement. In seven of them the design will entail both the LP and HP heaters. The other ten will have two strings of HP heaters only.

Eight units will be provided with condensate bypass demineralizers. Size of unit does not appear to influence the decision to have this equipment in the cycle.

Oxygen scavenging will be accomplished generally through the use of sulphite or hydrazine. Morpholine will not be used to the same extent. More than one chemical will be used at about a third of the units.

Supplementary Cooling Will Be Needed

Twenty units will have cooling towers. An increase over the 14 in the previous survey. Three towers will be for supplementary cooling. Cathodic protection at the intake or in the condenser will be used at 19 and 14 units, respectively. Four condensers will have insulated tube sheets.

Putting heaters in the condenser throat is considered standard design practice. As many as three heaters in the throat are indicated in the reports of some plants, and one unit will have four.

Copper alloys continue to be the accepted material for condenser tubes. But the use of aluminum alloys for the condenser tubes of seven units indicates the continued interest in new materials.

Three units will have the condenser tubes welded to the tube sheet to prevent contamination of the feed water by condenser leaks. The hot wells in 14 units, mostly large ones, will be compartmentized, in any effort to localize any leaking.

Thirty-two units will use open heaters for feed water deaeration. Twenty will perform this in the condenser, and both methods will be used in 17 units.

Motors are still the overwhelming choice for boiler feed pump drives. Five turbine and three main shaft driven pumps also were reported. But apparently plant operators and designers are awaiting the results of operating data from existing non-motor-driven boiler feed pump installations before using these methods to any great extent.

Trend Is Two Pumps Per Unit

Probably the biggest trend in boiler feed pump design taking place is the reversal in the number of pumps designers feel should be installed with each unit. In EW's 1954 survey 70% of the units reporting used three half-capacity pumps; in the 1956 survey this figure was 55%; and in this survey two-pump installations actually exceed the three-pump ones by two to one. The great confidence in the reliability of boiler feed pumps and their drives is certainly indicated by this trend.

Designers are using standard pumps with injection seals for forced circulation boilers rather than wet or hermetically sealed motor drives.

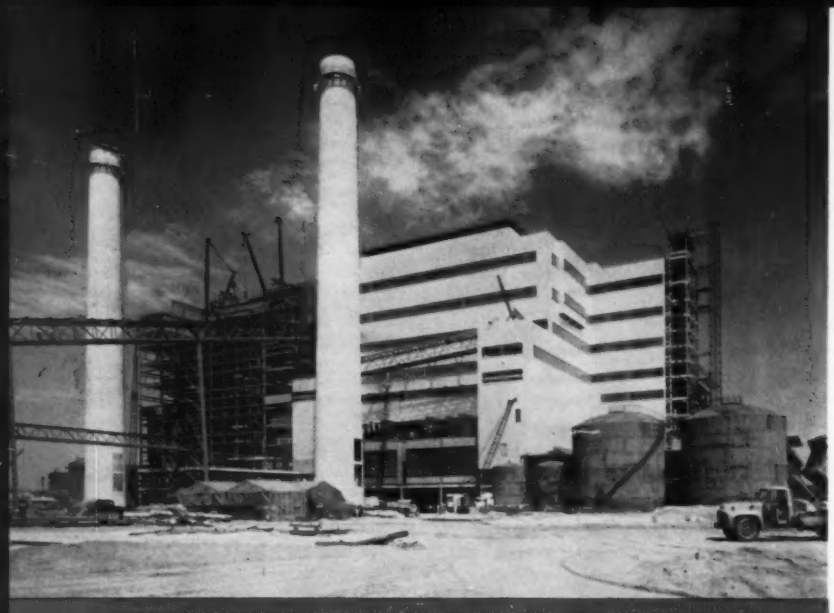
Mineral rather than aluminum shell continues to be the preferred method for insulating high-temperature piping. This has been evident in the last two surveys. Special routing and electric heating of piping will be used in 37 plants to avert freezing of essential piping. Hollow forging is most often used in the manufacture of main and reheat steam piping. Other procedures are shown in the accompanying table. Austenitic steel will be used in ten units, chiefly for main steam piping.

Although tandem-compound units are still the preferred arrangement of turbine elements, it no longer dominates. Fourteen cross-compound and 11 axial-flow machines are reported in this survey. The largest size axial-flow unit was 200 Mw. About one third of the cross-compound units will employ two high-speed shafts. All are very large units. Six units will have their HP sections shipped assembled.

Five generators with liquid conductor cooled stators were listed in the survey. In addition, there are 12 gas conductor cooled stator machines. Fif-

Table II—Type of High Temperature Steam Piping To Be Used

Type of piping for:	Main Steam	Reheat Steam
Forged & bored	12	3
Hollow forging	34	34
Seamless	14	12
Welded seam	2	14



EDDYSTONE STATION of Philadelphia Electric Co will have two supercritical pressure units. The first of these units is slated for June 1959 operation.

teen machines, not necessarily different ones, have gas conductor cooled rotors. About half of the utilities will have the generators for their units shipped assembled. Generator voltage will be predominately 13.8 kv although 18-24 kv will be used on some larger machines.

There are 19 main and 31 spare motor-driven exciters listed in the survey. This is about the same proportion as in the last report.

Big BFP Motors To Be Used

Both 2,400 and 4,160 v will be used for auxiliary power systems. Four out of seven will be at the higher voltages, most of these with the larger units. Although one 300 and one 275-Mw unit will use 2,400-v systems. About half of the auxiliary power systems will be ungrounded and the other half grounded either directly or through a resistance ground. An interesting observation is that some 4,160-v systems will operate ungrounded.

Motors as large as 350 hp will be fed from the low-voltage bus. While 5,000-hp boiler feed pump motors will be fed from the high-voltage bus in several stations.

The unit design will be prevalent in most of the units, but two and sometimes three auxiliary power transformers will be used for some of the large units.

There has been no change, at least statistically, in bus transfer. Half of the designers favor instantaneous transfers and half time-delay ones.

Putting power cables on racks seems to have lost its appeal to electrical designers. Only four utilities report that this will be done.

As many as four units will be controlled from one centralized control, according to the returns. In most instances, however, the returns indicate that one or two units will be controlled from the same location. But, as indicated in the last survey, it is not wise to generalize on these arrangements because the control of future units may be added to these existing control rooms.

Automation Has Effect

Automation is nothing new to the utility industry. The degree to which it has been used can readily be seen from the estimates of manpower requirement for the new units reported in the survey. Half of the plants in which these units will be installed will be operated with only three to four men (including watch engineer) per shift. Eighty percent of them willl require three to six men per shift. Most plants needing the larger number of men are coal-fired plants. The number of units in a plant is, of course, a contributing factor and accounts for the spread in personnel requirements.

Control room manpower requirements are even more illustrative of what automation means to the utility industry. Almost half of the new units will require only one control room operator per unit

Design Survey Check Chart Available

Copies of a chart containing detailed statistics on all the units reported on in the Fifth Steam Station Design Survey are available at 50 cents each. Address: Electrical World, 330 W 42nd St., New York 36, N. Y.

per shift. In some of the multi-unit plants the per-unit allotment amounts to less than one control room operator per shift. In 35% of the plants more than one control room operator per unit per shift will be required. But there is every reason to believe that as the number of units installed in these stations increases the per-unit control allotment will decrease.

Data-Logging Makes Appearance

Almost all plants where these new units will be located have or will have leased telephone line communications. Two thirds will have carrier for communications, and one third microwave. Seven new units will have data-logging equipment and two units will be equipped with station heat rate computers. It is interesting to note that four of the seven data loggers will be used with units that will be installed in existing plants. Both of these are steps in the direction of the completely automatic plant.

Most control cables will be placed in trays, although pipes, racks, and ducts will be used. In one third of the units, designers will permit putting control and power cables in the same tray.

Oil-base and butyl rubber will be used generally as the insulation material for power cables. Polyethylene is the choice for the insulation of control cable in about half of the stations. Oil-base and butyl rubber will be used also as insulation on control cables, but their use will not exceed that of polyethylene.

Neoprene is the choice for cable sheath on both power and control cable. There will be a considerable amount of PVC for control cable.

Copper is no longer the first choice for generator main leads. Sixty percent of the installations will use aluminum bus. And 24 aluminum installations are of welded construction. Isolated-phase arrangement will be used for most of the units' generator leads. But there will be an increase over those in the last survey in the number of field-fabricated jobs.

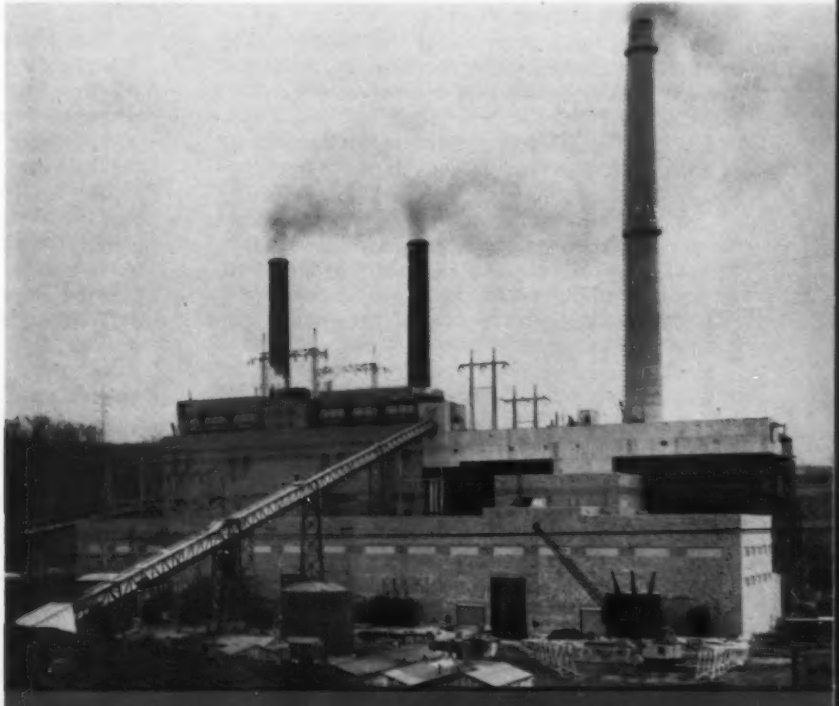
Most main power transformers will have fire protection equipment. Water generally will be the choice. Sixty-five of the 70 units reported in the survey will have FOA cooled transformers. Over half will be equipped with pressure relays to trip, and 28 with pressure relays to sound an alarm.

Unit Design Prevalent

All but eight units will have one main power transformer per unit. Five of the remaining units will use three, single-phase transformers per unit. These installations are for units 200 Mw or larger. The other three units will have two power transformers per unit.

Incandescent lighting remains the accepted method for station lighting, although there has been an increase in fluorescent lighting since the last survey. Nineteen units also will have mercury vapor fixtures. Lighting voltage usually will be 120/208 v. There will also be some 120/240-v installations, and three units where 277/480 v will be used.

Photo by Kaiser Aluminum

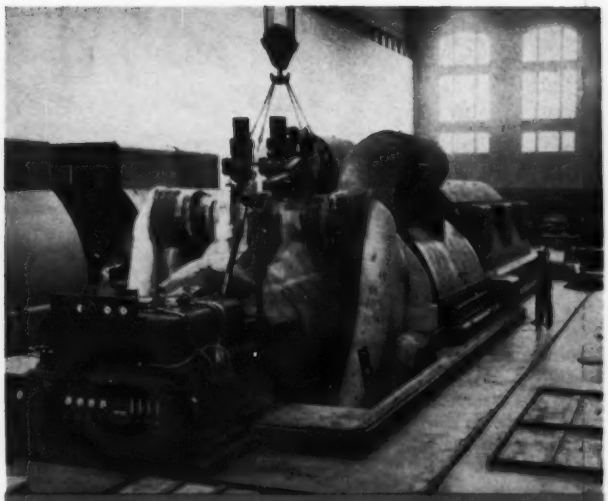


STUCCO EMBOSSED aluminum sheet is used as the lagging material to protect boiler parts and insulation against weather at Ohio Power Co plant

PLAN '59

Modernization Opportunities in Power Plants Are Many

- **Replacement of older units by modern ones has many proved advantages**
- **But most modernization accomplishments have centered around station control**



TAIT STATION of Dayton Power & Light Co was modernized by replacing old units with two 130-Mw units

If utility engineers closely examine their power plants they may discover many areas where plant modernization will pay off.

This is the conclusion reached after examining the examples of modernization uncovered by Electrical World's staff on the basis of interviews with utility, manufacturer, and consulting engineers.

These examples ranged from complete replacement of older units with modern ones to minor modification of small equipment in the plant.

Centralizing control in existing plants was perhaps the most often cited example of modernization. Other components of the power plant generally mentioned as possible subjects of modernization included:

1. Coal handling
2. Ash handling
3. Water treatment
4. Turbine-generator unit

Talks with leaders in the field indicate that there is very seldom, if ever, an economic justification for modifying the basic thermodynamic cycle of a unit. Either the entire unit is replaced or the major components are left alone. But modernization of some auxiliary systems offers a distinct possibility. And most such modernization can best be justified when a new unit is being added to the station considered ripe for modernization.

Following are some examples of plant modernization made in the past several years.

As indicated in the article on equipment obsolecence several utilities replaced old units with modern equipment. Dayton Power & Light Co's modernization of its Tait Station is a good example. Seventy Mw of old capacity was removed and replaced by two modern 130-Mw units. This represents a threefold increase in capacity.

The greatest deterrent to this particular modernization plan was the loss of 70 Mw of capacity during the demolition and construction stages of the program. It was actually necessary to initiate the project a year earlier so that the loss of the 70 Mw could be regained in time to meet load growth needs.

But the advantages of the project were many. For one thing, the capacity removed had long since passed its peak economy and suffered continuing deterioration requiring high maintenance. Well-worn coal handling facilities were inefficient. The expansion program also permitted elimination of congested and hazardous control cable installations.

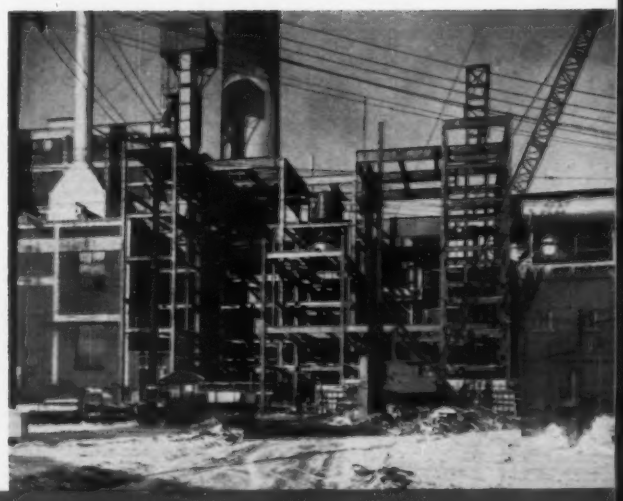
Using the Tait site for the new capacity required only a small investment to augment the existing transmission facilities and allowed the company to postpone its entry into the more costly higher voltage transmission field.

Other Improvements Could Be Made

The major replacement program also afforded an opportunity to make improvements in the remaining portions of the plant. The coal-handling system installed with the new units was extended to service the older units. And the ash handling system in the old plant was revamped.

To improve operations further in the old plant, all boiler feed and fan motor bearings were equipped with thermocouples, so that their temperature indications could be transmitted to the existing mechani-

REPLACEMENT OF UNITS at Niagara Mohawk's Huntley station requires heavy demolition and foundation work



TEN OLD BOILERS were replaced by three new larger ones at the Moline station at Iowa-Illinois G&E Co

cal control room. Mill air temperature dampers are now controlled automatically instead of manually. The soot blowers on the old boilers were changed from hand-operated steam blowing to automatic air blowing. These changes involved capital expenditures, but allowed the company to operate the older portion of the plant with 12 men fewer.

The modernization of the Huntley station of Niagara-Mohawk Power Corp is another example of improvement by replacement. In this instance capacity was increased fourfold by replacement of old 25-cycle equipment with two modern, 200-Mw, 60-cps, units.

A considerable savings can be credited the Huntley project because it removed the need for developing a new plant site at this time. It also did not require the acquision of additional line right-of-way.

There is an additional savings in common facilities, such as car dumper, boat unloader, coal conveyors and breakers, shops and offices, locker and storerooms, and circulating water intake etc. Further savings are made in top supervision and in operating and maintenance personnel when compared to that of a new station.

Replacement of units can be an attractive consideration for smaller utilities also. Several years ago Iowa-Illinois Gas & Electric Co replaced ten boilers and an obsolete 6,400-kw machine with three new boilers and two new 25-Mw units at its Moline station. Total cost was $9.25 million. The equipment removed was of 1910 vintage.

A similar modernization program was accomplished over a period of years at the Bay Front station of Lake Superior District Power Co. Several other examples of modernization through replacement have been mentioned already in the article on equipment obsolescence.

Control is perhaps the area of plant operation most prone to modernization. Centralizing the control functions at a station makes possible the relief of men for duties in other sections of the plant or in other plants.

Large Investments Not Required

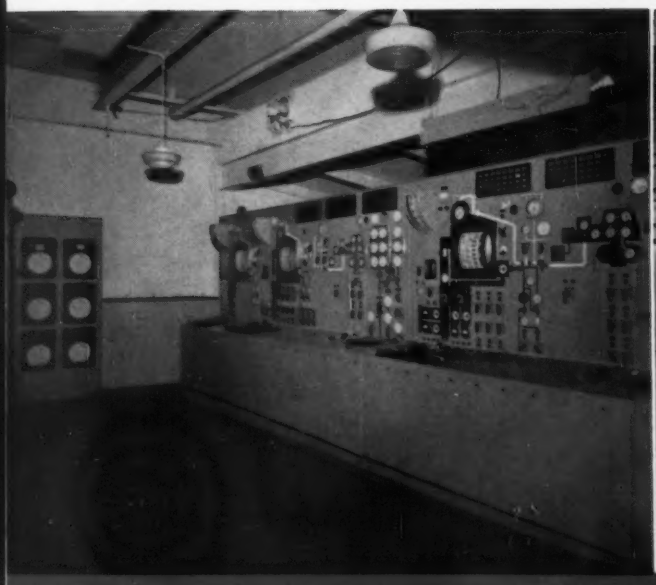
The amount of work involved in such a modification is extensive. But because it does not require large investments for additional equipment or the demolition of existing structure, justification for centralizing control usually can be demonstrated.

Here are a few examples:

Southern California Edison Co cut over its four-unit Redondo Steam Station Plant 1 from local to centralized control in a $1,015,000 operation completed 1956. The job was justified on a five-year payout basis, primarily on the basis of reduced operating manhours. Transfer of 28 experienced operators to new stations was made possible. Shift personnel at Plant 1 were reduced from 13 to six.

Redondo Plant 1 has four 72-Mw turbine-generators and seven 400,000-lb per hr ,900-psi, 850F boilers. Completed in 1949, it was considered Edison's most modern then, even though the controls were spread over 15 boards.

In conversion, which took place over more than a year's uninterrupted operations, essential controls and instrumentation were brought to repeater posi-



NEW CENTRALIZED CONTROL BOARD on left replaced separate panels at Florida P&L Co's Riviera No. 1 unit

NECHES STATION of Gulf States Utilities Co was modernized by automatic data logging equipment

tions in the slightly enlarged existing electrical control room. Modern, pre-fabricated control panels were used, and lighting modernized.

Most of the work was done during planned outages to minimize instrument and control outage time. Special precautions were taken during construction to protect electrical operators at existing controls from noise and debris.

Controls Changed Without Shutdown

Florida Power & Light Co made similar changes at its Riviera and Cutler stations. These changes, however, involved only one unit at each plant and were made when new capacity was being added to the stations. In both instances the modernization was accomplished without taking the units out of service. Consolidation of operations and conservation of personnel were again the justifying reasons.

Originally the control boards for the 50-Mw Riviera Unit No. 1 were equipped with old-type drives with spring positioners, old-type stacked relays, and old-type selector valves. The unit was installed in 1946. The turbine room had some turbine instrumentation. But much of the other instrumentation was localized. A new centralized control board was purchased for Unit No. 1 to match the centralized board then being installed for Unit No. 2.

The old recorders were converted to transmitting controller-indicators, drives were converted to cam operation and selector valves were changed. All 440-v switches were converted to 110-v control circuits. Those considered essential were brought into the control room. Pressure gages needed in the control room were replaced with air transmitting type and 3/15-psi receivers installed on the control board. Suitable instruments were installed to constitute a complete centralized control.

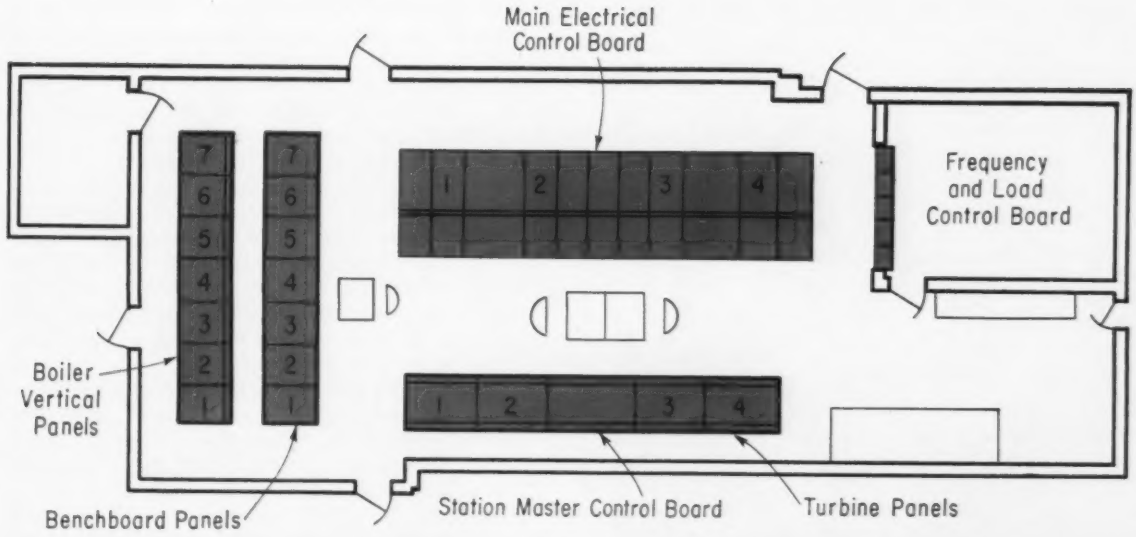
Similar changes were made for the Cutler No. 3 Unit when the fourth unit was installed.

Georgia Power Co is planning to modernize controls on a unit installed as recently as 1952. This will be done for the 40-Mw, Unit No. 1 of Plant McManus shortly after a new 75-Mw unit goes into operation in 1959. The modernization program will require relocation of controls from existing but separate boiler, turbine, and generator boards to a console panel in a newly constructed control room.

Modernizing control by centralization is not restricted to large plants. A Midwestern utility has under study a plan to centralize control for a plant consisting of three 30-Mw units. Even though these units have been relegated to stand-by service, it appears that attractive savings can be realized by consolidation of the control operations.

The section of this report on modern power plant design disclosed the anticipated use of data-logging equipment in several plants under design. The installation of such equipment at the Neches (EW Apr 22, 1957, p 60) and Riverside stations of Gulf States Utilities Co indicates that it also can be used to modernize the control functions in older plants. Service experience with the initial Neches central information system has proved that use of the equipment is economically sound. It has paid off well even during the development period . Gulf States' confidence in the system is demonstrated by the fact that it will install the equipment in its new station.

By scanning automatically and logging significant plant measurements, the "Central Information Center" has released 13 operating men at the Neches



CENTRALIZING the control at the Redondo plant of Southern California Edison reduced manpower requirement from 13 to six men per shift for a four unit plant. Conversion work was carried out during planned outages

station for operating duties elsewhere. Manual collection and logging of plant measurements have been eliminated. In addition the equipment has helped to improve operating efficiency of the 240-Mw station.

Modernization of the control system need not be confined to older plants. An example of making an efficient plant even more effiicient can be found in the installation of a central information system at the Milliken station of New York State Electric & Gas Corp.

A central information system, designed to reduce energy production costs through more efficient use of fuel and operating manpower, will be placed in service simultaneously with or shortly following the second 150-Mw unit at Milliken.

Better Use of Labor Important

The justification for using the system is based on the company's confidence that it will make feasible operation of the expanded 300-Mw capacity plant with the same number of operating shift employees now needed for operation of the one-unit, 150-Mw capacity plant.

In general, coal-handling equipment installed in the past 15 to 20 years can be considered modern when compared to present-day equipment. Yet the coal-handling facilities of older plants should be examined for possible areas of improvement, especially when new installations are being made.

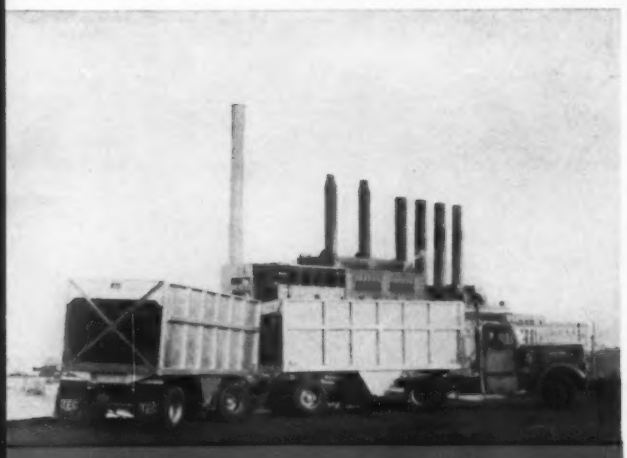
Better utilization of manpower is again the economic incentive. Manpower requirements may be reduced, particularly by simplifying and updating coal-handling controls. Weighing and sampling equipment, and dust control are other areas of this system that should be examined. Modern electronic weighing equipment takes less room, is easier to calibrate, and can provide remote indication.

The Cape Fear plant of Carolina Power & Light Co provides an example of modernization of coal-handling facilities. During the recent installation of the fifth unit, coal-handling facilities for the third and fourth units were changed. Before the new unit was installed these older ones were supplied from separate coal pits. Now they receive their supply from the same source as the new unit. The change eliminated the older pits and associated facilities. Consolidation of operation was achieved and maintenance expenditures were reduced.

Ash-handling systems have come a long way in the past 15 years. Reduced operating costs have been one result of the improvements. With present-day systems, it is possible to empty all points of collection in sequence, skipping any boilers not in operation.

Universal adaption of such a system to older coal-fired plants cannot, of course, be advocated . But it should be considered whenever an extension to an existing plant is contemplated. This is particularly true when the new unit will have automatic ash-handling facilities. In such circumstances an additional expenditure to automate the collection points in the older plant may decrease operating expenses.

What to do with collected fly ash has long been a problem for the utility industry. In 1956 fly ash production amounted to about 8.25 million tons, according to Bituminous Coal Research, Inc. Experts think that this figure may double by 1963. Perhaps the industry's biggest contribution to the solution of this problem is the modernization of its thinking on methods of ash disposal. It seems im-



NEW ALUMINUM tractor and trailer rigs permit Cleveland Electric Illuminating to carry big coal payload

SPECIALLY DESIGNED coal cars of 100-ton capacity can be emptied by gravity without use of car shakers

probable that the present methods of disposing ash in areas adjacent to plant sites or in abandoned quarries, etc., will be adequate for the future.

Utilization of the fly ash, therefore, should be investigated. More research and development of new products and uses for fly ash is of prime importance.

Water-treatment facilities are also prone to modernization. Modern treatment methods provide better quality and cheaper water. Demineralizers provide high-quality water for makeup at low-cost capital increment. Because of this it is advantageous to consider supplying older as well as new units from a new and larger water-treatment plant when a new plant extension is being made.

Under consideration of one utility is a plan to provide makeup water for two older units by the installation of a facility for those and new units. In this instance, the additional 90% capacity of the demineralizer plant can be provided for an increase in cost of about 30-35% more than the cost of the demineralizer plant for the new units.

Condensate demineralizers, considered necessary in a supercritical pressure cycle, have been under study for use in subcritical installations. High first costs are formidable but the ability to obtain deposit-free boiler and turbine operation is worth consideration. There is no reason why this supplementary equipment could not be considered for existing as well as new high-pressure installations.

Polishing demineralizers have also been installed in existing stations to improve water conditions where pressures higher than those of earlier units are used.

Reduction in operating manpower needs is likewise a fruitful area for modernization. Converting manually operated demineralizer equipment to automatic should be considered especially as part of an extension to an existing plant.

Consolidated Edison Co is experimenting with a device that will continually analyze and record substances dissolved in boiler water. The particular method under consideration will indicate the presence and concentration of those materials that can be detected by the colorimetric method. The analyzer can be applied to any water-raw water, condensate, demineralized water or boiler water. In fact, the utility is now using the equipment to detect the presence of phosphate in ten boilers in its Waterside plant. Better utilization of manpower and ability to obtain swiftly accurate records of boiler impurities should make equipment such as this an important part of any modernization plan.

Modernizing steam turbine generator units, thereby improving their operating condition, is certainly something that should be considered during this period when load demands are off.

Increase Generator Rating

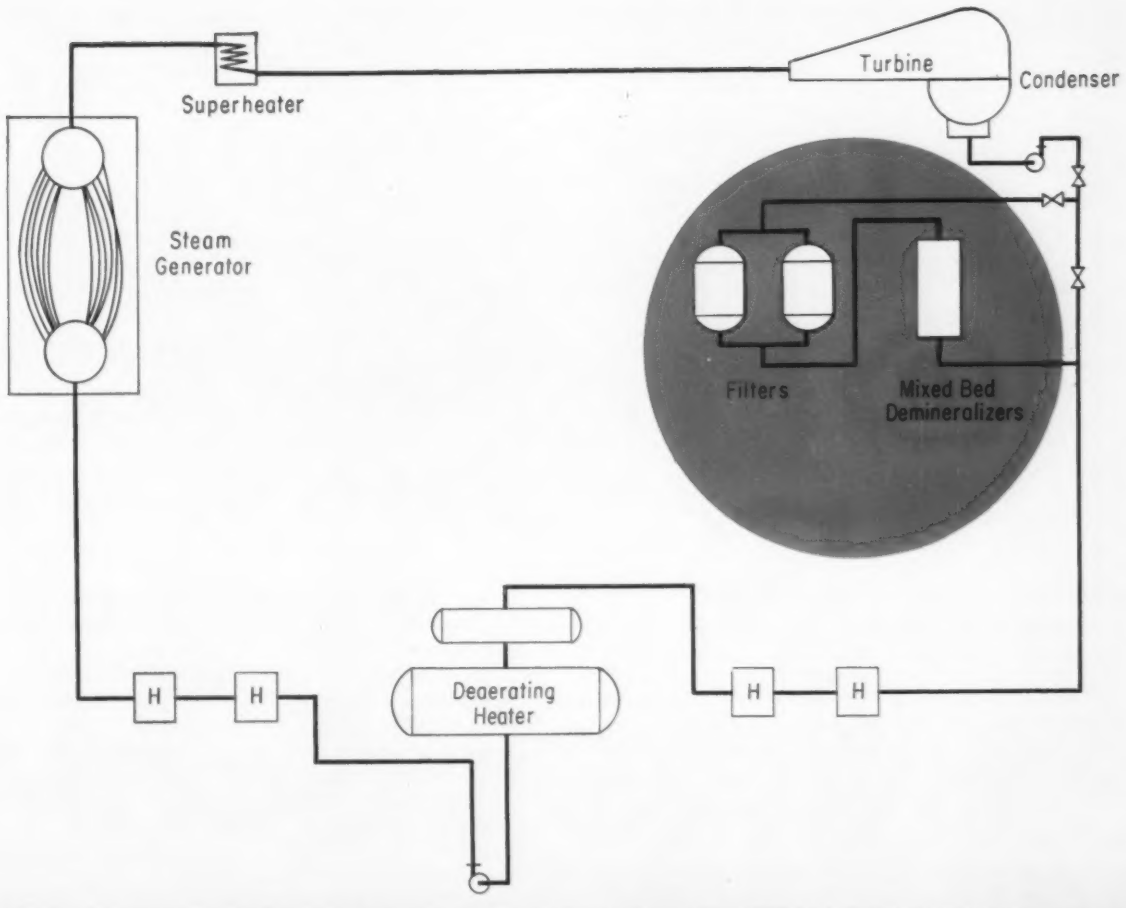
What should be done is, of course, an economic decision, but here are some things that might at least be considered. Within a given shell construction efficiency perhaps can be increased by improving steam passages. This can be done by tightening the clearances between the buckets and the diaphragm.

Where blade erosion is a problem, replacement with new and more efficient moisture-removal blades is a possibility. Changing from shaft water seals to steam seals on the turbine can improve both vacuum control and starting procedure. Modernizing the governor control system may improve regulation and make load control easier and more efficient.

Modifying existing 0.5-lb hydrogen-cooled generators to 15 or perhaps 30 lb ratings is a consideration. Increasing the hydrogen pressure by this amount will increase the generator kva output 15%. This may be a very desirable, provided the extra transformer and line capacity can be provided.

To increase the hydrogen pressure may require only a piping change, a modification of the seal oil system or, perhaps, a complete change in the hydrogen scavenging system. But the return on the investment is appreciable.

One other factor concerning steam turbine-generators should be given careful consideration by engineers and management. This is the fact that as time goes on utilities will have to operate some of their large, modern reheat machines in a cyclic rather than base load manner. Now may be an propitious



DEPOSIT-FREE boiler and turbine operation is greatly aided by use of condensate demineralizers. They are used in supercritical pressure cycle and could also provide advantages for the subcritical high-pressure units

time to modify these units so as to prepare them for this type of operation. It may become advantageous to start such units quickly. The objective should be to minimize thermal shock effects.

Several possible control modifications might be evaluated. A steam by-pass system, similar to those installed by the Consolidated Edison Co on some of its large units, may be appropriate. Or perhaps only the addition of temperature-indicating devices in the outer and inner casing, the first stage nozzle and the exhaust hood plus several other strategic locations may be all that is necessary to follow the steam and metal temperatures closely enough to achieve rapid controlled starting.

In addition to modernizing plant facilities, utilities should reexamine their thinking about future energy sources. By 1975 electric utilities will be burning some 450 million tons of coal annually compared with an annual consumption of 130 million tons now.

Will present methods of supplying this needed coal be adequate for the future? J. E. Tobey, president, Appalachian Coals, Inc, thinks not. He feels that we are not prepared with our present supply methods to adequately solve the problems involved in assuring a three-fold increase in the coal supply between now and 1975.

In a full report available from Appalachian Coals, Inc, Tobey indicates that the major problems include:

1. Availability of capital financing for new mines.

2. Logistics.

3. Development of sturdier and faster mining machines.

4. Design of preparation plants specifically for utility coal.

The situation calls for some master planning, embracing overall objectives not only of the utility and coal industries but also of allied industries as well. Thinking must be modernized beyond the short-range future to consider the questions cited in the box on the next page.

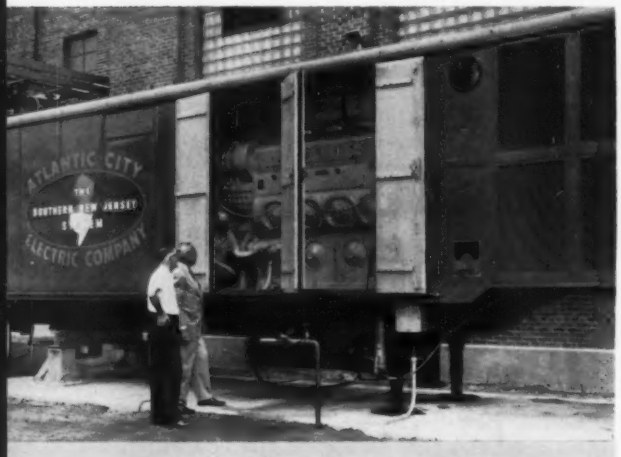
In the future, utility demand on the coal industry can be meant only by the use of more prime products from the mines. There simply will not be enough inferior coal and by-products to supply utility de-

Some Basic Questions About Utility Expansion and Utilization of Coal

1. What will probably be the geographical expansion pattern of the electric utility industry?
2. What will probably be the geographical expansion pattern of the coal industry to meet it?
3. Will power station sites be located farther from load centers and nearer large coal reserves?
4. Will large power stations be built on inland and ocean waterways for condensing water and fuel transportation facilities?
5. To what extent will power stations be built on top of coal reserves with the use, where necessary, of cooling towers?
6. What is going to happen with respect to the electric grid systems geographically and with respect to higher voltages and load-carrying capacities?
7. In 1975, what will be the ratio of energy distribution by rail, water, pipeline, conveyor, and hv transmission?
8. How can coal mining and preparation methods be best integrated to utility requirements?
9. What will be the optimum degree of coal preparation?
10. What will be the best utilization of capital at both the power station and the mine?
11. What will be the best correlation between coal mining, preparation, and burning equipment?
12. How do incremental costs of coal burning affect power generation costs?

mands. Coal quality thus will take on added importance. It should be given careful consideration in pricing methods and will become an important factor in plant design.

The coal industry advocates long-term contractual arrangements with one or more reliable coal producers to assure adequate supply for the large power plants of the future.



Diesel Unit Provides Start-up Power

Self-starting equipment, recently installed at the Missouri Street Station of Atlantic City Electric Co provides extra reliability. The self-starting equipment is a 500-kw packaged diesel-generator set. It consists of a diesel generator, switchgear, fuel oil tanks, and all necessary auxiliary equipment in a completely enclosed highway trailer.

This start-up equipment can be started and brought up to operating speed in about 30 seconds.

They claim that this practice will insure an uninterrupted coal supply. It should stabilize coal quality and result in a more uniform product.

The changing character of future utility coal requirements suggests that such a course should be given careful consideration.

Another area for modernization is in the purchase of heavy power plant equipment. Statistics demonstrate the peaks and valleys in the manufacturing output of concerns that build this equipment. Obviously the capacity required to satisfy peak demands is idle during periods of low production. Such cycles are inefficient and costly.

Correction of this inefficient scheduling becomes increasingly important as time goes on. The spread between peaks and valleys will undoubtedly increase as electric power demands soar in the future. Even now boiler manufacturing facilities are not sufficient to meet the projected demands of 1960-61.

A continual increase in manufacturing capacity may be possible. But this does not solve the basic problem. It merely postpones the need for basic corrective action—assuming stability in the industry can be maintained in the interim.

Flattening out the ordering curve appears to be the logical solution, yet it is not a simple and complete answer. For example, it would seem to shift the financial burden to the buyer under present regulatory practices. On the other hand, it may more than compensate for any such burden by precluding the escalated charges which result from the traditional "crash" ordering pattern, and the penalties inflicted by an inflationary economy when expenditures for new plant are delayed.

And manufacturers contend that with a less hectic program more time can be spent with the customers engineers in thoughtful calm consideration of necessary equipment details.

Obviously the problem is complex and requires serious consideration. Consequently it is imperative that industry "modernize" its thinking in this area to attain stability for the growth ahead.

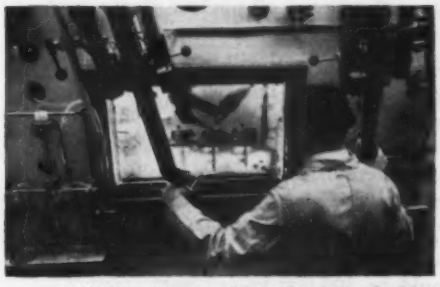
At General Electric . . .

- **Reactor operating results**
- **$20,000,000 nuclear center**
- **3500 man-years of atomic experience**

LEAD THE WAY IN ATOMIC PROGRESS

Operating results—VBWR

Experienced personnel—3500 man-years.



$20,000,000 integrated research and plant facilities.

Leadership in the nuclear field is gained from outstanding designs, facilities, and personnel, together with reactor operating experience. Toward this end, General Electric's Atomic Power Equipment Department has designed and built a wide range of power and research reactors, notably the Vallecitos Boiling Water Reactor. It has completed a $20,000,000 integrated nuclear facility, including its headquarter's engineering and manufacturing center at San Jose, California and the Vallecitos Atomic Laboratory, near Pleasanton, California.

Here, highly experienced scientists, engineers and technicians are applying a combined total of 3500 man-years of nuclear experience to the development of high-quality products and services, such as:

Power reactors—for electric-generating plants and ship propulsion featuring boiling water reactors.

Research and test reactors—for all research, industrial and educational applications, featuring the Open Pool Research Reactor, Pool Training Reactors, and the General Electric Test Reactor.

Fuel—for power and research reactors, including plate-type and rod-type elements.

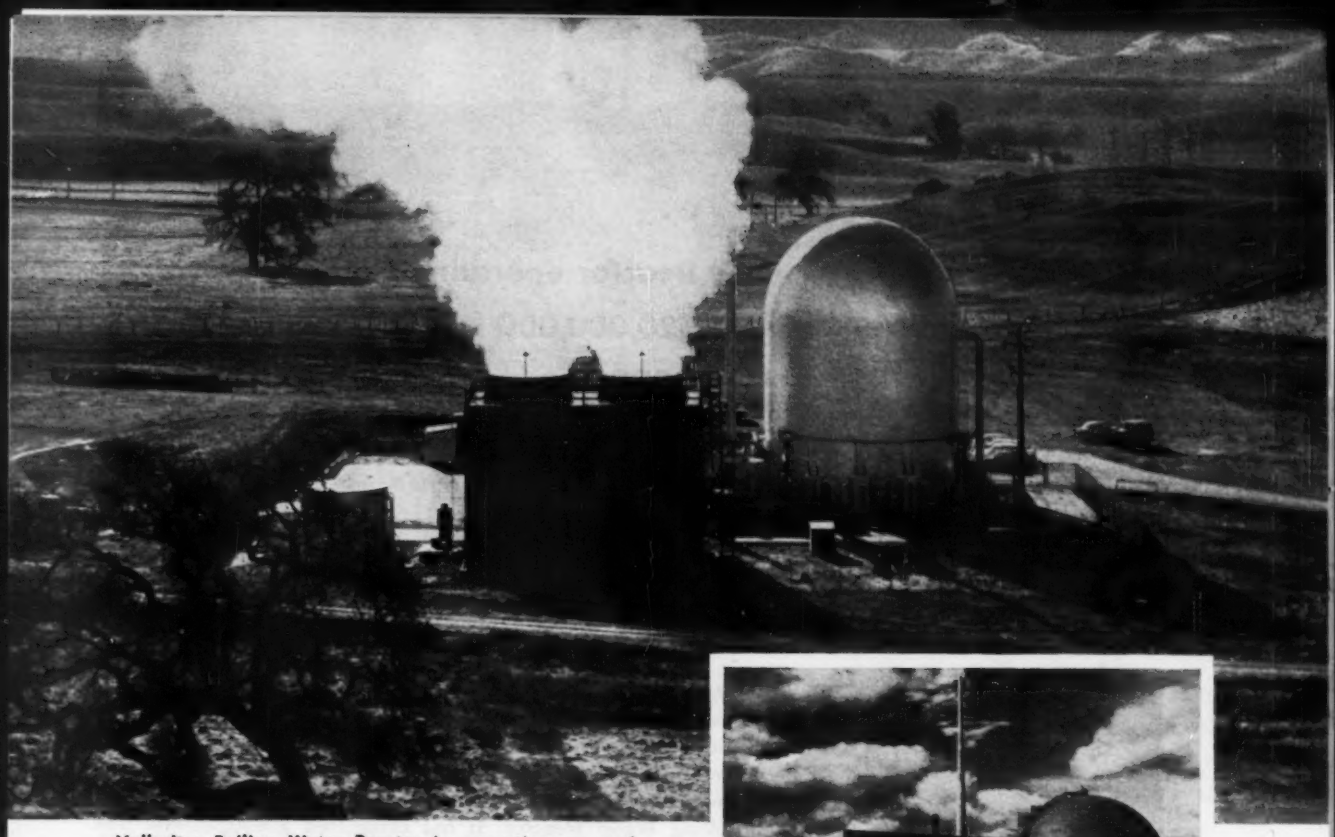
Components—including control-rod drives, instrumentation, servicing equipment, and liquid-metal equipment.

Laboratory services—including irradiation space in the GETR, VBWR, and the Radioactive Materials Laboratory.

Development studies—including advanced reactor design studies in boiling water and other reactor technologies, fuel studies, and physics investigations.

FOR MORE INFORMATION SEE NEXT THREE PAGES

GENERAL ELECTRIC



Vallecitos Boiling Water Reactor in operation on cool California morning with condenser-circulating-water vapor rising from cooling tower. Inset—Dresden station, largest U. S. all-nuclear plant, nears completion.

VBWR operation, Dresden design experience, prove potential for

LOW-COST NUCLEAR POWER

THE VALLECITOS BOILING WATER REACTOR at General Electric's Vallecitos Atomic Laboratory has shown, through ten months of test operations, the great potential of the boiling water reactor for producing economical nuclear-electric power in the near future. Power has recently been increased by 50 percent—from 20,000-kw(t) to 30,000-kw (t)—and an application has been made for a license to operate at 50,000-kw(t).

The VBWR has been supplying the United States' first privately financed atomic-electric power since October 1957, in conjunction with the Pacific Gas and Electric Company.

Operation of the VBWR has shown the direct-cycle boiling water reactor design to have:

- **greater power potential than contemplated**
- **rapid load response**
- **negligible radioactivity carryover allowing direct-contact maintenance on turbine**
- **stability of operation over all pressure and thermal outputs.**

Primary purpose of the VBWR is to obtain operational experience applicable to the Dresden Nuclear Station, the largest all-nuclear plant scheduled in the United States. The Dresden station, rated at 180,000 kw(e) net, will have a G-E dual-cycle boiling water reactor. The station will provide electric power in the Chicago area in 1960.

If its fuel elements were to be redesigned, yet keeping the same core size, this same boiling water reactor plant would have a potential of 245,000 kw(e) net. For a similar system with increased pumping, turbine-generator unit and auxiliary, the potential would be 300,000 kw(e) net.

GENERAL ELECTRIC

First fuel element for Dresden station, country's largest all-nuclear power plant, being placed in shipping drum.

Ready now to serve all your atomic needs— a $20,000,000 facility.

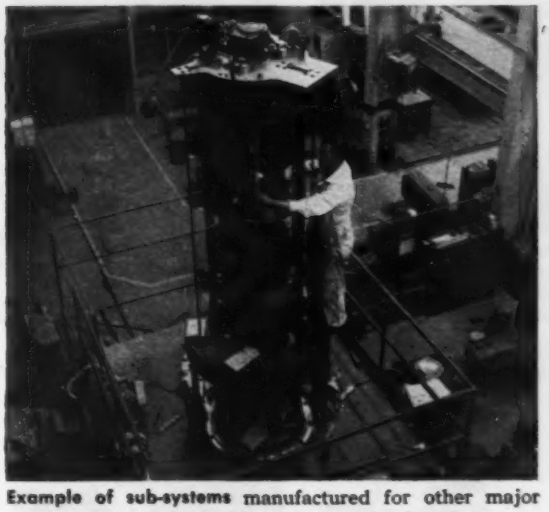
General Electric's commercial atomic facilities are ready to help you with the application and technical advancement of atomic energy. Manned by a top technical staff, the engineering and manufacturing facilities at San Jose, California include general manufacturing, fuel fabrication and special testing areas.

A new mechanized production line reduces costs and provides optimum quality control for rod-type fuel elements. G-E plate-type fuel elements are made with a new pressure-bonding manufacturing process which eliminates need for welding or brazing.

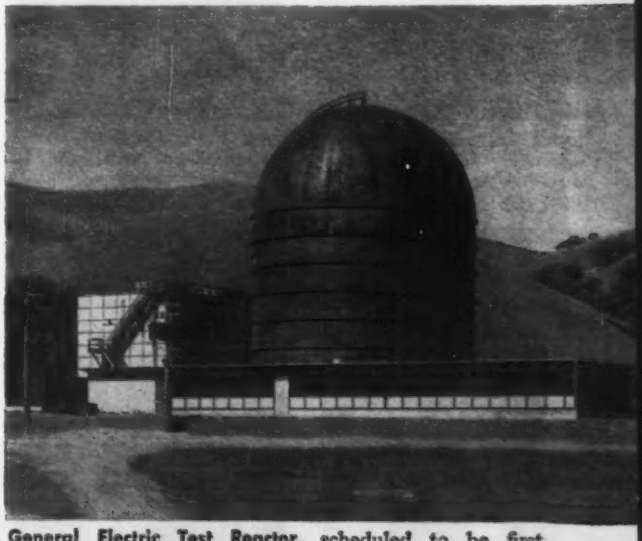
The Vallecitos Atomic Laboratory is a completely equipped commercial facility devoted entirely to nuclear investigation and experiment. Major installations are the Radioactive Material Laboratory, Experimental Physics Laboratory, Vallecitos Boiling Water Reactor, and the General Electric Test Reactor.

Services of the Laboratory include nuclear materials studies, materials irradiation, hot-cell work, physics and radio-chemistry studies, reactor operations research, and irradiation testing in the Vallecitos Boiling Water Reactor and the General Electric Test Reactor.

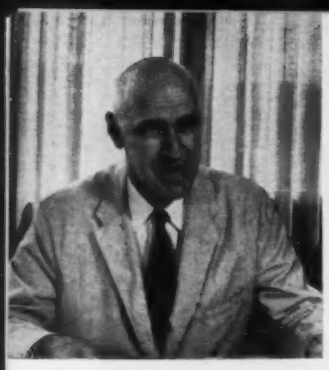
Open-pool research reactor assembled for low-power operating tests before shipment to Spain.



Example of sub-systems manufactured for other major reactor projects is fuel-handling mechanism being assembled at San Jose plant.



General Electric Test Reactor, scheduled to be first private test reactor in operation, has irradiation space available for use by industry. Rating is 30,000 kw(t).



RALPH D. BENNETT—Manager—Vallecitos Atomic Laboratory, Ph.D., M.S., B.S., 11 years' atomic experience.

ROBERT B. RICHARDS—Manager—Engineering, Ph.D., M.S., B.S., 11 years' atomic experience.

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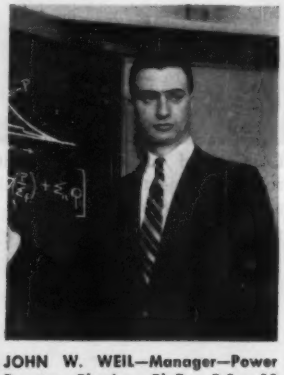
W. KELLY WOODS—Manager—Nuclear Materials, Ph.D., B.S., 16 years' atomic experience.

DONALD H. IMHOFF—Manager—Engineering Development, B.S., 8 years' atomic experience.

SAMUEL UNTERMYER—Consulting Engineering—Reactor Technology, B.S., 12 years' atomic experience.



JOHN W. WEIL—Manager—Power Reactor Physics, Ph.D., B.S., 10 years' atomic experience.

BRUCE R. PRENTICE—Manager—Nuclear Applications—Europe, B.S., 12 years' atomic experience.

THOMAS TROCKI—Specialist—Development Projects, B.S., 11 years' experience.

3500 MAN-YEARS BACK G-E ATOMIC PROGRAM

Experience means leadership and at General Electric commercial atomic programs are directed by 550 highly experienced scientists, engineers and technicians. Of these, 123 have advanced degrees including 42 doctorate degrees. Many have outstanding international reputations, covering a variety of different nuclear technologies. 196-12

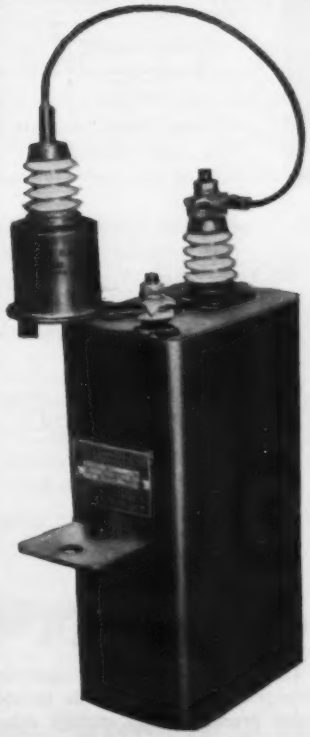
Take advantage of General Electric's know-how in the atomic field. Call your nearest Apparatus Sales Office or write to: Atomic Power Equipment Department, General Electric Company, San Jose, California for more information on these products and services. Outside the United States and Canada, write to International General Electric Company, Dept. 58-12, 150 East 42nd Street, New York 17, N.Y.

GENERAL ELECTRIC

ANOTHER GENERAL ELECTRIC

Kilovar Plus . . .

Cap-Gap Solves Distribution Voltage Problems



New General Electric Cap-Gap series capacitor and self-clearing protective gap allows economical loading of voltage-limited distribution transformers and supplies valuable peak-load kilovars

Here's what the new Cap-Gap does for you . . .

- Makes transformers virtually self regulating.
- Improves secondary voltage.
- Solves flicker problems caused by motor starts.
- Supplies peak-load kilovars.

Here's how it works. The Cap-Gap actually cancels transformer reactance. When abnormal voltage conditions exist across the capacitor, a self-clearing gap protects the transformer, capacitor and system by automatically bypassing the capacitor once each half-cycle. It automatically reseals itself and reinserts the capacitor when normal voltage is restored. Cap-Gap units are rated 2, 3, 5, and 7½ Kvar, 240, 480 and 720 volts and can be used with 2400, 4800 and 7200 to 7960 volt distribution transformers 10 to 37.5 KVA.

No maintenance is required. There are no moving parts to wear out and both the capacitor and gap have stainless-steel cases and alumina-ceramic bushings. Cap-Gaps can be easily installed on either old or new distribution transformers.

See for yourself how the new G-E Cap-Gap can help you with your distribution voltage problems; contact your nearest General Electric Apparatus Sales representative, or write for Bulletin GEA-6855, General Electric Co., Schenectady 5, N. Y.

445-22

GENERAL ELECTRIC

Mineral-Insulated Heating Cable Application-I*

J. W. **BEAN**, Electrical Equipment Section, American Electric Power Co, New York, N. Y.

Application. Data are presented for the application of mineral-insulated heating cable as a protection against freezing of outdoor steam, water, oil, and gas piping, also on piping at older plants, such as hydrogen vent pipes. Accompanying sketches, also subsequent table and graph, give the basic information required.

Type of Heating Cable Used. Mineral-insulated heating cable contains twin copper-nickel alloy conductors and has a seamless copper sheath over-all. Rating is 300v, 250 C, and 0.06 ohm per conductor-foot. Performance characteristics of such cable will be given in Part 2.

Affixing Cable to Pipes (see Fig 1). For pipes operated below 500 F, the heating cable should be applied next to the pipe and parallel with it before insulation is applied. For pipes operated above 500 F, heating cable should be applied over the first layer of pipe insulation.

To hold the cable in place before applying pipe insulation, 1-in. paper masking tape should be wrapped on the pipe at 3- to 4-ft intervals. Where the heating cable passes valves, S-shaped loops should be made to give additional heat and to allow for cable elongation or contraction.

At the power-supply end, the cable should be looped around the pipe and left with a free end to protrude at least 1 ft after the pipe insulation is applied. This will allow for power connection, thermal changes in cable length, and afford structural rigidity.

Termination of Dead-End (see Fig 2). The dead-end may be under pipe insulation or protrude from it. If the terminal is buried, its position should be marked on the outside of pipe insulation.

Termination of Supply End (see Fig 3). Supply end of the heating cable should be looped before connecting to allow thermal changes in cable length and movements of the pipe. At least 7 ft of copper cable with high-temperature insulation is required between the power-supply terminal box and the heating cable, otherwise the latter's high temperature will damage supply cable insulation. Two-conductor No. 14 safety mineral-insulated cable is used for this connecting link, and spliced to the heating cable as shown in Fig 3. Power-supply terminal box should be located on building steel or masonry.

Power-Supply and Control. A 115- or 230-v single-phase power supply is used depending on the wattage required for pipe heating. Control may be manual circuit breaker or automatic contact-making thermometer and small contactor, depending on requirements.

Where many pipe heaters are energized simultaneously, numerous heating cables may be fed from stepdown transformers controlled manually by a single switch at a central point. This controls magnetic contactors on the primary sides of the transformers, energizing them and the heating cables. Supervision of the cables may be by pilot lamps.

Precautions. Mineral-insulated heating cable and mineral-insulated wire have magnesium oxide insulation which changes to magnesium hydroxide in the presence of moisture. Hence when moisture is absorbed the insulation resistance decreases. This should be avoided, although the cable may be dried out by heating several feet on the ends with a blow torch.

To prevent insulation absorbing moisture from the atmosphere, the cable ends should be sealed with compound promptly after cutting, otherwise enough moisture can be absorbed in one hour to lower the resistance.

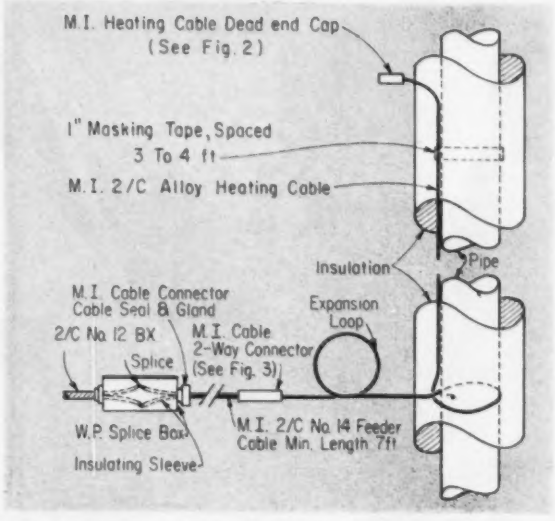


FIG. 1. Heating cable connections includes exposed loop to keep heat from supply cable splices

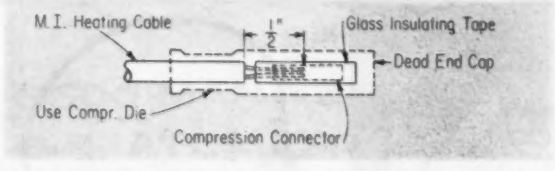
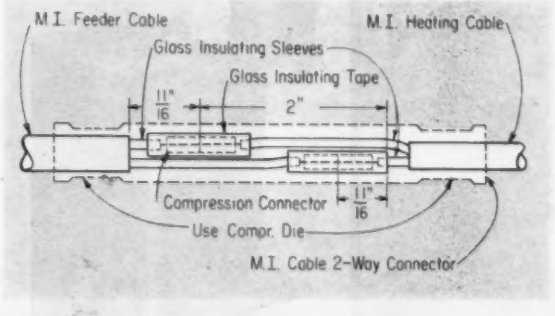


FIG. 2. Insulated cap covers unused heating cable end

FIG. 3. Insulated joint connects supply to heating cable



* Cable performance characteristics and wattage for heating the pipe will be presented in a subsequent issue.

For multiple circuit street lighting...

THESE 9 ADVANTAGES MAKE KW ALUMINUM CABLE YOUR BEST BUY!

- **Lighter weight than copper for equivalent current-carrying capacity**
- **Light weight simplifies installation handling**
- **Light weight reduces shipping, handling costs**
- **Easy to bend, form, train and cut**
- **Simple to splice, tap and terminate**
- **Lower overall cost per foot**
- **Excellent resistance to weathering**
- **Excellent flex characteristics**
- **Backed by 68 years of cable and insulation know-how**

To offer utilities greater cable values than ever before, KW has brought its pioneering development in aluminum conductors together with the 68 years proved experience of "the masters of insulation" (formerly U. S. Rubber Wire and Cable division).

For multiple-circuit street lighting systems, KW recommends the constructions described at right. And for wire and cable to fill any utility requirement, call on KW specialists through your KW distributor or Kaiser Aluminum Sales Office.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, Calif.; *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.

KAISER ALUMINUM

IF IT CARRIES CURRENT, KW *CARRIES IT!*

SEE "MAVERICK" • SUNDAY EVENINGS, ABC-TV NETWORK

Power Supply Cables—Aluminum Conductor

Single or multi-conductor cables, stranded aluminum, sizes 4 AWG and larger, up to 15 KV, shielded or non-shielded.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket.
For wet or dry locations up to 75° C. Type USE, Style RR, up to 600 volts.

Specification No. 831-S, up to 15 KV
Kalzone insulation—Neoprene jacket.
For wet or dry locations up to 90° C.

Pole and Bracket Cables—Aluminum Conductor

For use in circuits where voltage between conductor and ground does not exceed 600 volts. Sizes 8, 10 and 12 AWG, 7 strand aluminum.

Specification No. 819-S
Street lighting cable, Neoprene type,
Figure 8 Ziplite construction.

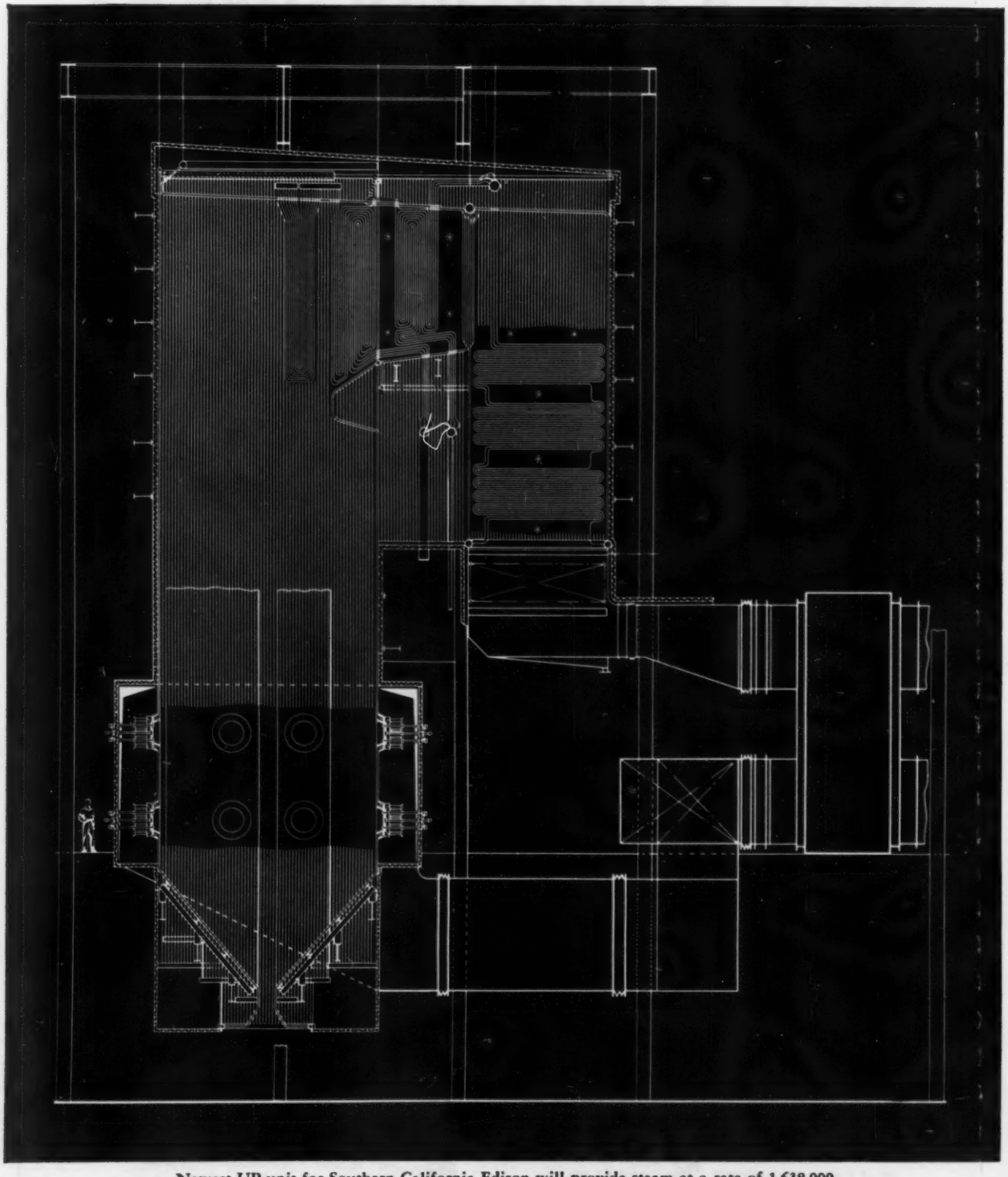
Specification No. 820-S
Performance insulation—weatherproof braid.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket. Type USE, Style RR.

Specification No. 202-S
Type UF Cable, PVC insulation—PVC jacket.

Specification No. 942-S
Laytex® insulation—Neoprene jacket,
Figure 8 Ziplite construction.

A Big Step Forward—



Newest UP unit for Southern California Edison will provide steam at a rate of 1,638,000 lb per hour to a 210,000 kw turbine at a pressure of 2,400 psi and at a temperature of 1,050/1,000 F. Completion of the unit, which will burn either natural gas or oil, is scheduled for November, 1960.

Why Southern California Edison Purchased B&W Universal Pressure Boiler for 2400 PSI Operation

Once-Through Unit Reduces Capital and Operating Costs —Makes Use of Variable Pressure Possible

A big forward step in holding the line on the cost of producing electricity was taken by Southern California Edison in purchasing two B&W Universal Pressure units for its station at Huntington Beach, California.

Solid savings both in installed first cost and in operation stand behind this decision. Here are the facts:

INSTALLED COST

1. The overall cost of a Universal Pressure Boiler represents a saving over a drum type boiler for identical conditions.
2. Because height and weight of the UP Boiler are much less than those of drum type boilers, there are worthwhile savings in building and construction costs.
3. Superheat, hot reheat and cold reheat steam piping are reduced.
4. Foundation costs reduced because of 650 ton saving in weight of unit.
5. Drum transporting and lifting costs eliminated.
6. One level of stairs, walkways and elevator landing eliminated.

OPERATION

Many significant advantages from the UP's unique operating features helped shape Southern California Edison's decision. Here is what they found:

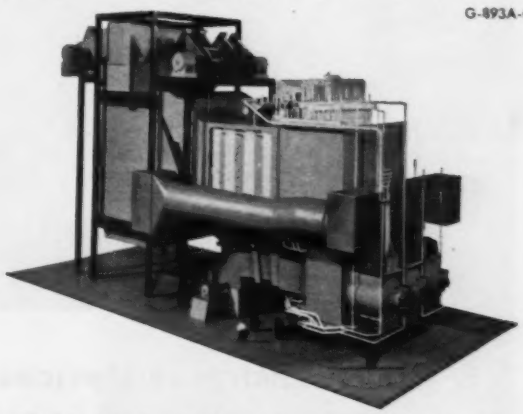
1. Constant steam temperature at all loads without use of tempering equipment.
2. Rapid response to load change.
3. Quick start up and shut down.
4. Simplified control system during normal operation.
5. Minimized operating complications when turbine is tripped.
6. Complete flushing of preboiler and boiler system is accomplished during every start up and shut down.
7. Reduced dependence on safety valves.
8. Elimination of water level gauge glasses and indicators.
9. Ease of acid cleaning.

The Universal Pressure Boiler helps the utilities' pressing need to hold the line on most of the important factors affecting cost of power generation.

Behind its many benefits stands the concrete performance of America's first successful commercial application of the Universal Pressure principle at the Philo Plant of the Ohio Power Company on the American Electric Power System. This unit has had a full year of performance under diversified conditions. Performance, ease of operation and freedom from major troubles have exceeded even the optimum original expectations.

We would be glad to discuss with you the advantages that the Universal Pressure Boiler can bring to your plant. Write to The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-893A-C5



Model of the first Universal Pressure Boiler, which is now operating, uses once-through principle by which water, under pressure, is forced in one end of the system and emerges at the other end as superheated steam. This principle eliminates need for a drum.

BABCOCK & WILCOX

BOILER DIVISION

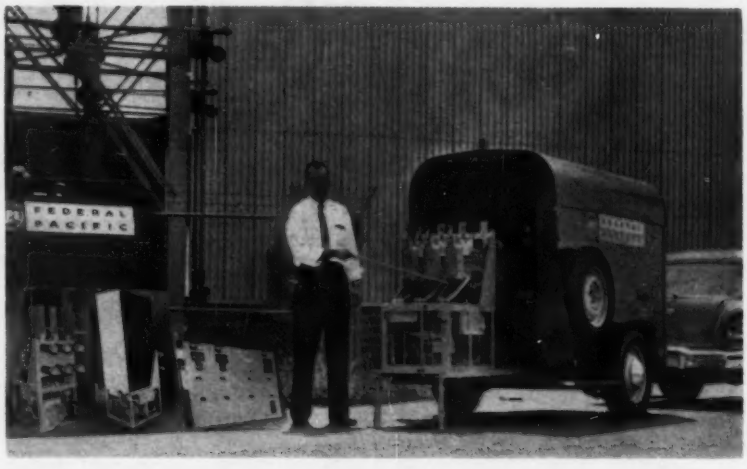
Manufacturers News

Federal Pacific Sends 250,000-Kva IC Breaker on Tour

A year-long, nation-wide tour, to promote sales of its DST-5-250 air circuit breaker has been started by Federal Pacific Electric Co, Newark, N. J. Don Munday, sales specialist, will carry the breaker in a special auto trailer behind a station wagon.

The 125-v, d-c, metal-clad, unit, 1,200 amp, 5 kv, with a 250,000 kva interrupting capacity, is designed for use by utilities, industrial plants and in other heavy electrical installations. It was manufactured at the company's Eastern Switchgear Div, Scranton, Pa.

The trailer is equipped with a battery source and charger, and a demonstration arc chute.



S & C Demonstrates Devices on 'Pole'

A distribution equipment mobile demonstrator which shows actual physical operating of disconnects, cutouts, Loadbuster, fuse links, and handling tools is now being used by S & C Electric Co., Chicago, Ill. The demonstrator, shown above, carries its own collapsible cross "pole", an aluminum frame which lifts the equipment 12 ft above the ground. The unit is being shown to electric utilities to explain how to achieve maximum safety in the operation of distribution equipment.

When the tail gate of the station wagon opens, a telescoping rack rides out, a section of it rotates 90 deg, and supporting feet drop to the pavement. Then a battery powered motor, raises the crossarm with the equipment. Panels illustrate techniques in high-voltage circuit interruption.

Asplundh Develops Insulated Aerial Lift

An outer boom, constructed of Spiralloy, is a new design in hydraulic aerial lifts for line work and tree trimming. Two units of this construction have been developed by Asplundh Tree Expert Co, Jenkintown, Pa. The announcement at this time coincides with the company's 30th Anniversary of service to the electric utilities.

The hydraulic aerial lifts incorporating the new construction are known as the Line Lift, and the Trim Lift.

In explaining the new unit, Lester Asplundh, executive vice president, said, "We have felt for years the real answer to an aerial lift would be complete insulation of the man in the bucket so that in effect he would possess the protection of a bird on a wire.

"Recent technology in the fiber glass industry has now made possible this new unit. Any workman aloft, in our opinion, must never be half safe but completely safe. The new unit gives precisely that degree of protection."

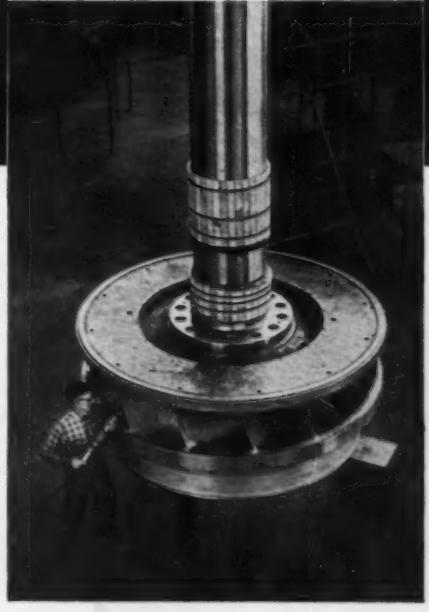
"We know that existing hydraulic aerial lifts can be modified with this new Spiralloy outer boom. It

(*Continued on page* 102)

Another B-L-H boost for our bustling Northwest... two 56,000 hp Francis-type turbines for Big Bend

◀ Down shot of partially assembled turbine unit built by B-L-H's Eddystone Division for The California Oregon Power Company's Big Bend Project.

A Francis-type turbine runner for The California Oregon Power Company being machined at Eddystone. ▼



Mighty B-L-H turbines at 28 huge dams in the expanding Pacific Northwest are producing almost 3 million kw every hour they run. Soon to swell the number are two Francis-type turbines which The California Oregon Power Company—an all-hydroelectric system—will install in its Big Bend Project near Klamath Falls, Oreg. Built by the Eddystone Division of Baldwin-Lima-Hamilton, each of these turbines is rated to produce 56,000 hp at 277 rpm under 440-ft. head.

Eddystone is also supplying two large butterfly valves for this project, and B-L-H's Pelton Division is furnishing the governors.

In addition to all four basic types of hydraulic turbines—impulse, Kaplan, Francis and propeller—Baldwin-Lima-Hamilton also manufactures governors, surge suppressors, valves, special pumps, and other accessory equipment. For additional information, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.

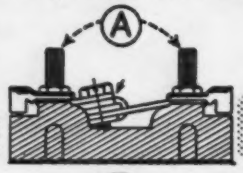
BALDWIN · LIMA · HAMILTON

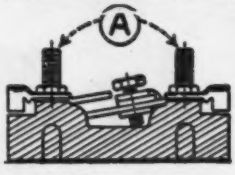
Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Special machinery • Bending rolls • Machine tools

Here's How
STATES TYPE NT
TERMINAL BLOCKS
Allow Circuit Check Without Disturbing Permanent Wiring





IT'S AS EASY AS A-B-C . . .

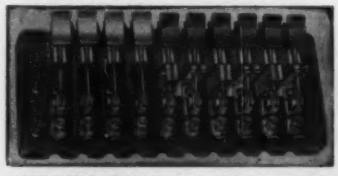
A. Just attach instrument to terminal posts.
B. Slide link out of contact—take reading.
C. Slide link back and bolt in position . . . That's all!

States Type NT Terminal Blocks are engineered for quick, safe, economical circuit checking. They're built in any number of poles desired, front or back connected, with or without coding strip, with or without cover.

Make sure your
TEST BLOCKS have

EXCLUSIVE STATES FEATURES

- New Safety Grip Handle assures safer, easier gripping
- No live parts extend beyond base.
- Maximum pressure at jaw contacts.
- Large selection of pole arrangements.
- Nickel corrosion-resisting finish insures good contact, attractive appearance.
- Angle bent studs permit quick changing from front to back connection.



"SMK" TEST BLOCKS. Solid base type. Over 2,000 combinations of pole arrangements.

THE STATES COMPANY
19 New Park Ave., Hartford, Conn.

I am interested. Please send further information on:
☐ Test Blocks ☐ N. T. Terminal Blocks

Name ..... Title .....
Name of Firm .....
Address .....
City ..... Zone .... State .....

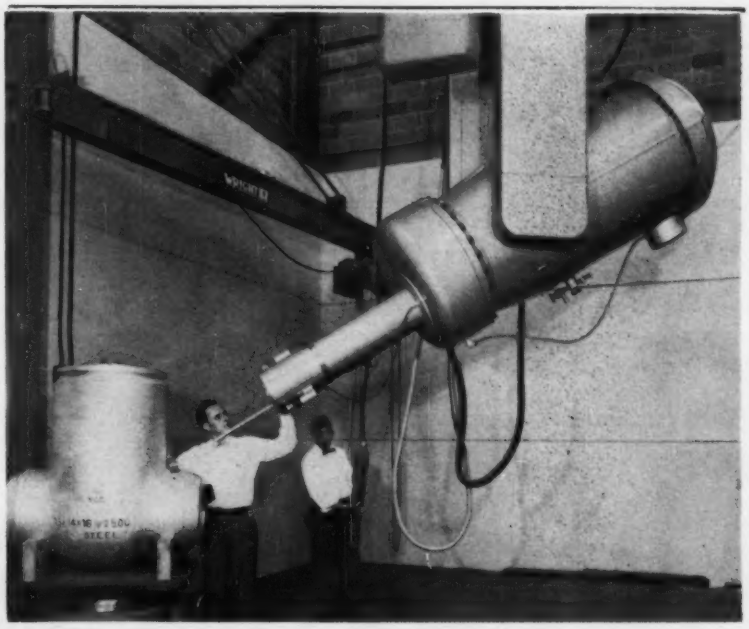
Asplundh Develops Lift (*Continued from page* 100)

provides absolute insulation from the bucket all the way down to the knuckle connecting the outer and lower booms," said Asplundh.

Utility representatives who have seen the units feel that the design represents a major step forward in insuring the safety of utility line crews.

To determine the safety quality of the boom, the Spiralloy pilot model was flexed over one million times and then loaded to destruction —fracture occured at 4,600 lb, according to the company.

The Line Lift and Trim Lift will be distributed and serviced nationally by the Asplundh organization.



ACCO Inspects with X- and Gamma-rays

A 2-million electron-volt Van de Graaff radiographic X-ray generator (illustrated) and a Gamma-ray Cobalt 60 pile have been installed by American Chain & Cable Co at its Reading, Pa., facilities. With the use of these new pieces of equipment the company feels they are in a position to produce sounder castings, make deliveries earlier, and reduce manufacturing costs to the customer, according to C. N. Johns, president.

The X-ray is for repetitive work, thus used for speed, and the Gamma-ray is a one-shot operation, used for expediency. With these two units, used for non-destructive testing purposes "on stream," the company will be able to make internal examinations of castings, pressure-seal valves, weldments and other machines at an accelerated rate, reportedly more than eight times faster than previous methods. The new set-up can produce 140 films per day, or 33,600 per year.

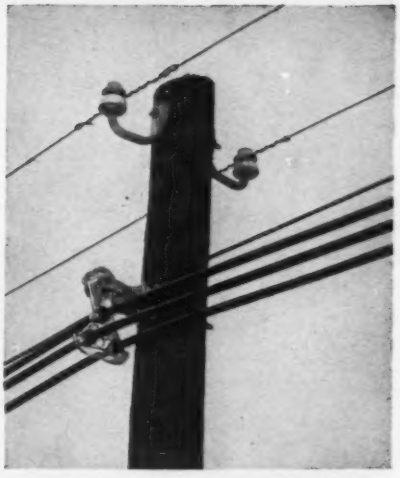
The X-ray generator, operated on a high-vacuum, low-pressure principle, is equipped with a newly designed "sealed-off" tube, and a refrigerating system to supply a constant source of circulating water for rapid heat dissipation.

The generator is in a room with 4 ft thick walls. All castings are X-rayed with 36-in. focal distance.

Isotope radiography, with the 10 Curie source of Cobalt 60, is complementary to the inspection program. Gamma-ray units are better suited for thin sections of metals, while X-ray is best for the heavier sections, according to the company. Gamma-rays are similar in their characteristics to X-rays.

(*More Manufacturers News page* 106)

New Roeclamp* with Roeplastic® Cable Costs 60% Less than Self-Supporting Cables, Minimizes Tree Problems, Installs with Ease, Looks Better!



New Roebling ROEPLASTIC Cable with ROECLAMP requires only one foot of clearance through trees! Note improved, compact appearance. No crossarms are needed.

Designed for 5kv systems (2400/4160Y and 4800 v delta) and 8kv systems (4800/8320Y and 7200 v delta), the Roebling Aerial Spaced Cable actually costs 60% less than conventional self-supporting cables. It provides a neat, compact appearance, improved voltage regulation, higher current-carrying capacity, and positive phase identification.

Up to three conductors can be carried by ROECLAMPS, which are suspended from a strong messenger. The messenger also provides protection against lightning and falling limbs.

Aluminum conductors come in 17 standard sizes and strand constructions, and are made with a greater number of finer strands for extra flexibility. Many types of extruded insulations are available, depending upon proposed usage. ROECLAMPS come complete with grommets to fit cables and messenger you order.

Ask your Roebling representative to show you the remarkable new ROECLAMP. He'll tell you more, too, about the unusual savings and improvements you can effect, or write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

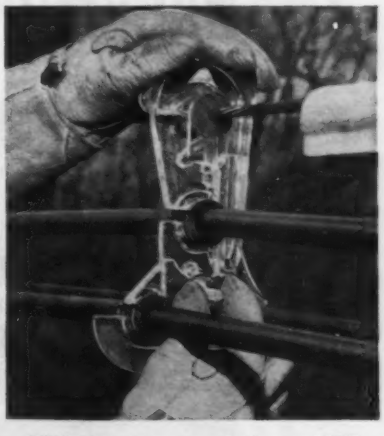
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roeclamp has unit construction . . . installs in seconds—without tools!

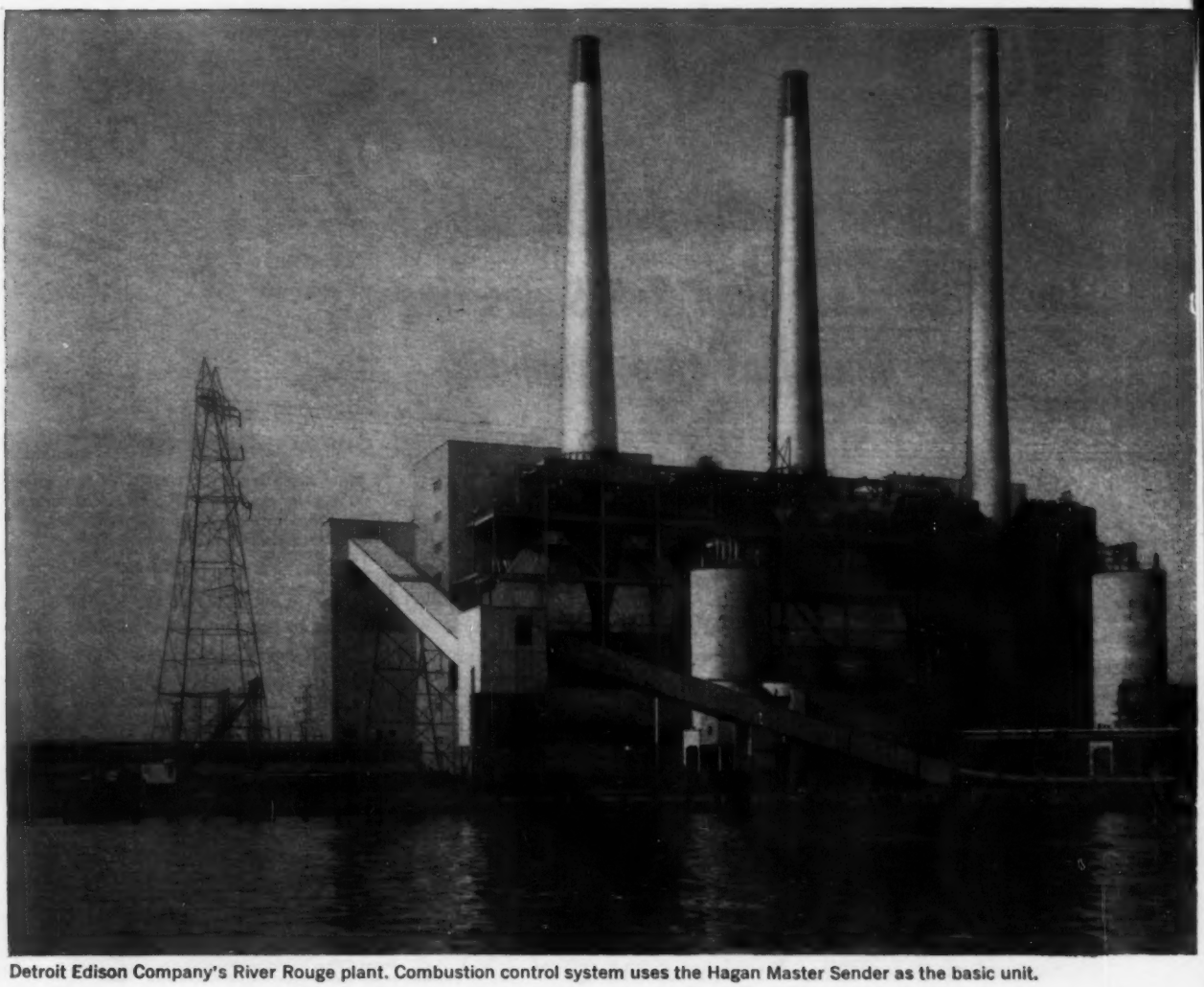
One motion and ROECLAMP is on messenger and ready to receive conductors. Phase changes and repairs do not necessitate removal of clamp. ROECLAMP comes complete with grommets to fit messenger and conductors you order.

Note how easily conductors drop into place. Installation is measured in seconds, even with "boxing gloves" on. ROECLAMP is Plexiglas†, tests to over 1000-lb. breaking strength, offers outstanding weather resistance, best possible electrical properties.



35 ROECLAMPS are required every 1000 feet. Installation is completed by hand-tightening of nut. Not even a screw driver is required!

*Pat. pending
†Reg. T.M.—Rohm & Haas Co.



Detroit Edison Company's River Rouge plant. Combustion control system uses the Hagan Master Sender as the basic unit.

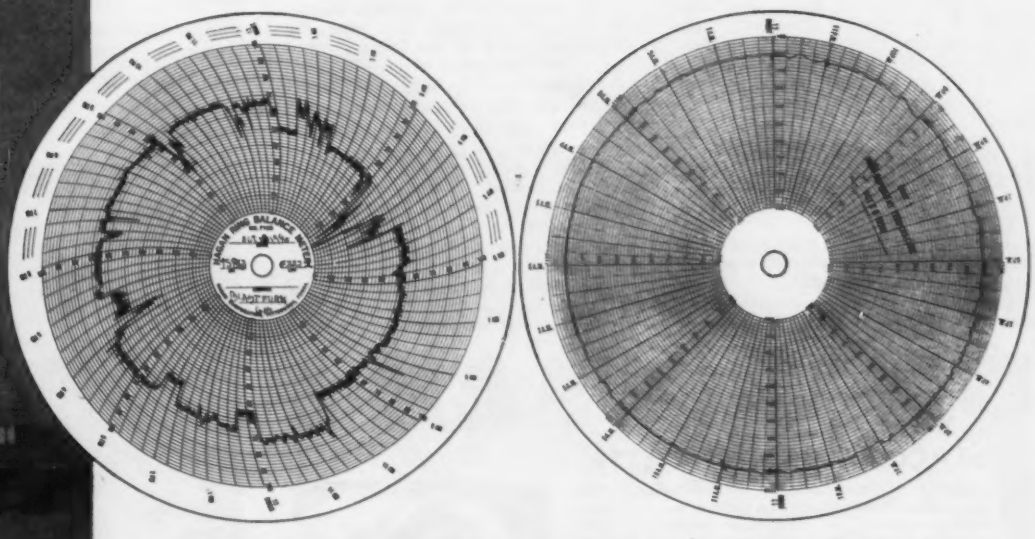
HAGAN CONTROLS ALL THREE BOILERS

Control panel and Console at the River Rouge plant. Close check on all phases of station operation is facilitated by the high accuracy of the Hagan Ring Balance meters.

Main firing aisle. Here Hagan Power Positioners regulate the flow of pulverized coal to meet steam demand accurately and dependably.

BLAST FURNACE GAS

MAIN SUPERHEAT TEMPERATURE



This comparison of Blast Furnace gas flow and Main Superheat Temperature shows how closely Hagan control maintained the set point, regardless of the fact that BF gas flow fell to zero almost instantaneously at one point. Note the suppressed range of the superheat temperature chart (600°F-1100°F), each division is only 10°.

AT DETROIT EDISON'S RIVER ROUGE PLANT

Detroit Edison Company's River Rouge plant easily qualifies as one of the nation's largest steam generating plants. It has three huge twin-furnace boilers, each made by a different manufacturer. *But all three boilers* are equipped with Hagan Combustion Control, Hagan Steam Temperature Control, Hagan 3-Element Feedwater Control and Hagan metering.

Fuels used are pulverized coal and blast furnace gas from a nearby steel mill. In spite of wide and sudden variations in the flow of BF gas, steam temperature and header pressure are held within established close limits. Steam temperature control includes flue gas recirculation and attemperation for unit #1; burner tilt and attemperation for unit #2; firing split control with a heat-exchange type attemperator for unit #3.

Hagan 3-element feedwater control system has proven advantageous during startup, blowdown, and shutdown periods. Fully compensated for variations in pressure and temperature, the Hagan system permits maintenance of accurate automatic control over a wide range of operating conditions.

Hagan's experience with the design and construction of control systems for every type of boiler, plus leadership in the exact control of multiple fuel firing, was a valuable asset in building the River Rouge systems. Hagan's highly qualified field engineers also contributed to the rapid and successful completion of this unusual installation.

Hagan skills and experience are available to you. A letter or phone call will bring complete information, or a Hagan engineer will be glad to discuss your particular problem.

HAGAN CHEMICALS & CONTROLS, INC.

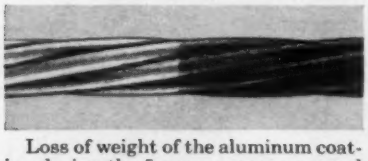
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

ADVERTISEMENT

Rugged 5-year field test proves superiority of ACCO ALUMINIZED Strand

Convincing proof of ACCO ALUMINIZED Steel Strand's matchless ability to "stand up" in highly corrosive, heavy industrial areas is furnished by a 5-year field test recently completed by a leading Eastern power company.

A section of ACCO ALUMINIZED High Strength Guy Strand, installed in 1953, was removed and subjected to thorough examination, including various laboratory tests and measurements. The wire surface was covered with a formation of sulfide, oxide and soot; but, after scrubbing with soap and water, the aluminum coating was shown to remain *bright, smooth and unattacked* by the highly sulfurous atmosphere (*see photo*).



Loss of weight of the aluminum coating during the 5-year exposure proved negligible. Tests showed that the physical properties of the wire and coating continuity were exceptionally good. All in all, the determinations indicated that the ACCO ALUMINIZED Strand would give *many additional years of outstandingly satisfactory service.*

"Far Greater Life . . ."

In another test, the ability of PAGE ACCO ALUMINIZED Strand to withstand exposure to extreme salt atmospheres is proved, as revealed by the following excerpts from a letter written by an official of a public water authority:

"We have obtained excellent results with ACCO ALUMINIZED guy wire. We ran several tests in the Metropolitan Area where there was exposure to the salt atmosphere from the sea. We used galvanized strand and your (ACCO ALUMINIZED) strand on the same poles.

"Results indicated *far greater life* for ALUMINIZED. After 8 months, the galvanized was rusted, whereas the ALUMINIZED showed no signs of oxidation or deterioration. As a result of our tests, our original purchase of ACCO ALUMINIZED guy wire was followed by another, and larger, order. This wire is used where we must have a product with high resistance to corrosion."

PAGE STRAND

of ACCO ALUMINIZED STEEL

In 1954, PAGE announced to the industry the successful development of a process for combining two time-tested but dissimilar metals, on a production basis, into a revolutionary new wire for increased resistance to corrosion: *Steel* for strength coated with *Aluminum* for corrosion-resistance.

Early laboratory results on accelerated Salt Spray testing which were favorable to ACCO ALUMINIZED over galvanized by a wide margin, are now being confirmed by results of field tests on installations of ACCO ALUMINIZED Strand exposed to the elements over a period of 3 to 5 years. The remarkable performance of the product in both industrial and marine atmospheres is now assured.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire. Available in a wide range of sizes, in 3-, 7- and 19-wire construction. It can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware.

ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength, and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

Other PAGE Wires of ACCO ALUMINIZED Steel

ACSR Core Wire

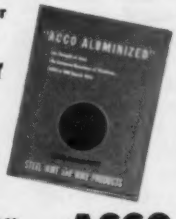
PAGE ACCO ALUMINIZED ACSR Core Wire is now available from leading manufacturers of aluminum conductor cable.

Chain Link Fence

PAGE Chain Link Fence of ACCO ALUMINIZED Steel Wire fabric, provides longer-lasting protection at a long-range saving.

Also . . . ACCO ALUMINIZED Telephone and Telegraph Wire, Barbed Wire —and other products

SEND TODAY for Booklet DH537-A. Write our Monessen, Pennsylvania office



ACCO for Better Values

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

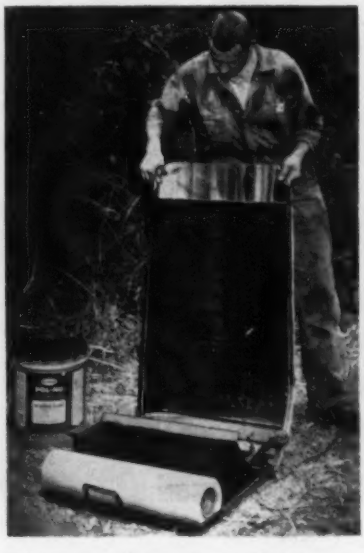
ACCO

TRADE MARK

Penn-Union Markets Insulation Peeler

A tool designed as an insulation remover is made available by Penn-Union Electric Corp, Erie, Pa. Plastic insulation such as linear polyethylene can be peeled easily and quickly without nicking or scratching the conductor, according to the manufacturers.

The tool, manual or hot-stick operated, is hooked over the insulation, tightened and rotated. The insulation "chip" falls away and exposes the bare conductor.



Chapman Designs Cutter for Pole Bandages

The Pol-Nu Bandage Maker, a portable machine that produces in seconds pole bandages of any size as they are needed, has been developed by the Chapman Chemical Co, Memphis, Tenn. It is reported to be an inexpensive device for cutting to the minimum the cost of groundline preservative treatment of standing poles.

The unit holds a 300-ft roll of poly-kraft paper and approximately 40 lb of Pol-Nu. As the paper is pulled through the device, a preservative coating of the desired thickness is laid on it. Thickness is adjustable from ⅛ to ⅜ in.

A template provides adjustment of the bandage width to 15, 18 or 22 in. A saw-tooth edge is provided

(*Continued on page* 108)

Engineered for Tampa Electric

Peninsular Florida's first modern coal-fired power station

On land reclaimed from Tampa Bay, Stone & Webster Engineering Corporation has designed and constructed Tampa Electric Company's Gannon Station. Here, following extensive cost comparison studies, coal is being used for the first time in an area previously utilizing oil. Stone & Webster is now at work on Gannon's Unit #3 which, when completed in October, 1960, will bring gross plant capability to 456,000 kw.

Stone & Webster Engineering Corporation is proud of its world-wide reputation for creating such low installation and operating cost designs — and of its long history of successful engineering in many industrial fields on jobs of varied size and complexity. For help on your next engineering project simply call our nearest office.

Stone & Webster builds installation and operating savings into your project through engineering economies and extra plant efficiency.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

HIGH PRESSURE FEED WATER HEATER
retubed by CONSECO
FOR PHILADELPHIA GAS & ELECTRIC

CONSECO's Field Department is equipped and thoroughly qualified by over 30 years' experience to repair, re-tube or re-build any type of tubular equipment, of any manufacture. Extensive facilities and personnel handle emergency assignments on the job or in our own shops. A CONSECO re-built unit is usually a better product than the original equipment because it benefits, during repairs, from our familiarity with all types of tubular equipment and of features that help to achieve longer, trouble-free, more efficient operation.

Full maintenance and spare parts service available. Emergency service at any hour, day, night, holiday; anywhere on the continent. Just call Maintenance Department.

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When equipment is repaired or rebuilt thoughtfully, as CONSECO does, changes in design, care of construction and ease of maintenance are developed that improve the original product. The application of these improvements to NEW EQUIPMENT DESIGNED BY CONSECO brings genuine profits to users of CONSECO products.

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For more data consult Chemical Engineering Catalog pages 559-562

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COMPLETE BULLETINS SENT ON REQUEST

Chapman Cutter

(*Continued from page* 106)

for quick cut-off of the bandage as it emerges. The prepared strip is wrapped around the previously evacuated pole at the groundline and adheres without stapling.

The bandage treatment method is expected to give up to 10 or 12 years of additional life, according to the company.

Worthington Decentralizes, Re-aligns Sales Forces

A program that divides the company into independent operations has been completed by Worthington Corp, Harrison, N. J. The firm now functions as though it were a federation of smaller companies. Worthington has also adopted a "gear-to-the-customer" program, the company's term for the modern marketing concept. These steps are part of an almost total company re-alignment which started in 1949. The recent change in trademark (EW, Sept 29, 1958, p 74) was part of this changeover.

The first step is a divisionalization program. Here, Worthington combines two advantages: The speed and knowledge of customers, markets and products of a specializing company; and the advantages in finance, diversification, and functional specialists of a large company.

Among the reasons for this change, Walther H. Feldmann, president, gives:

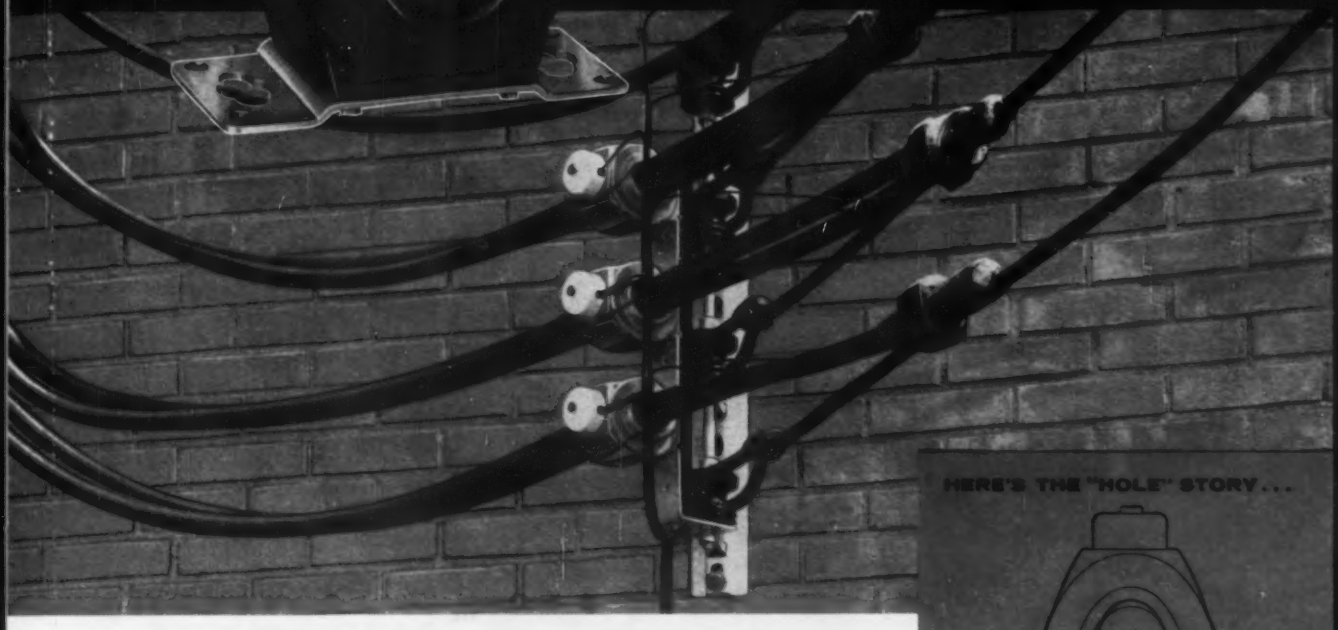
1. Provides the agility, speed of decision, and teamwork to match smaller specialized companies.
2. Places authority to make decisions as near as possible to where actions take place.
3. Retains important advantages of a large diversified company.

In the second step, Worthington's sales force is divided into two areas: direct sale and re-sale. In the first, individual technical representatives are assigned account responsibilities. In the second, distribution representatives serve a variety of distribution relationships.

Under this set-up, the company has a marketing service wing of the Marketing Division to provide product and marketing planning, marketing research, and advertising and marketing promotion.

COLOR-CODED
Transformers are encapsulated in colored epoxy resin to readily indicate ampere range.

NEW SANGAMO Type BH*
600 VOLT
INDOOR-OUTDOOR
CURRENT
TRANSFORMER



200-400-600-800 AMPERES
and with new DUAL RANGE 200/400 amp feature

The new Sangamo BH-6 current transformer gives many extra values over previous designs. The *dual range feature* sharply reduces the number of costly transformer change-outs —meets the 0.3 accuracy class on all loads from 20 to 800 amperes. The *oval-shaped window* combines the advantages of both round and obround type—has greatest usable opening of any 600 volt current transformer.

Compact design—more than 40% smaller than smallest similar 200 amp. model, is easier to mount, and is the lightest transformer in its class—only 5½ pounds.

All hardware is of durable stainless steel. Type BH transformers are available in flat-bar and window type construction. Get full details—write for Bulletin 503.

CERTIFICATE OF TEST

A certificate of factory test is supplied with all current transformers. This means that every Sangamo transformer is tested thoroughly before shipment . . . arrives ready for you to put on the line.

*Big Hole

SANGAMO Electric Company

SPRINGFIELD, ILLINOIS

SH58-6

HERE'S THE "HOLE" STORY . . .

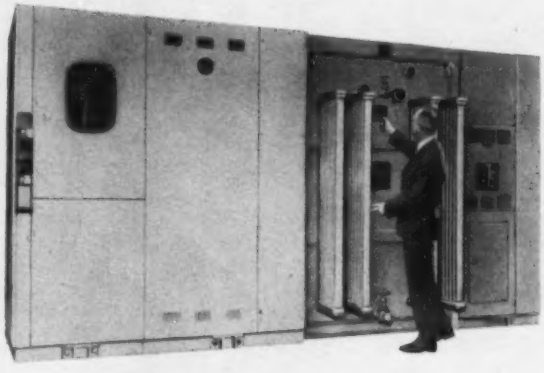
Sangamo's exclusive oval opening gives greater flexibility in application. It will take two 750 MCM conductors with 600 volt insulation, or . . .

by utilizing the large center of the oval, will accommodate one insulated 1250 MCM conductor.

New Equipment

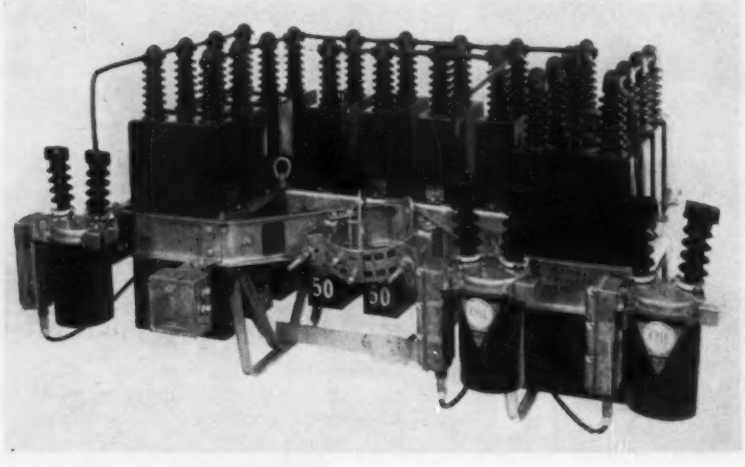
(For additional information, use Reader Service form, p 120)

Packaged Substations . . . .



. . . are available in 16 models and in ratings from 45 to 3,000 kva. They will step down primary voltages in 2.4 to 13.8 range to secondary voltages from 208/120 through 600 v. Transformers in these Transfo units may be oil filled, Askarel filled, and sealed or ventilated dry types. Disconnect devices for primary side include liquid or oil-filled terminal chambers; liquid-filled disconnect or interrupter switches; oil-filled disconnect fuse cutouts; and air-filled interrupter switches, fused or unfused. Distribution devices on secondary side can be tailored to particular requirements.

Transformer & Rectifier Div, I-T-E Circuit Breaker Co, Philadelphia 30, Pa

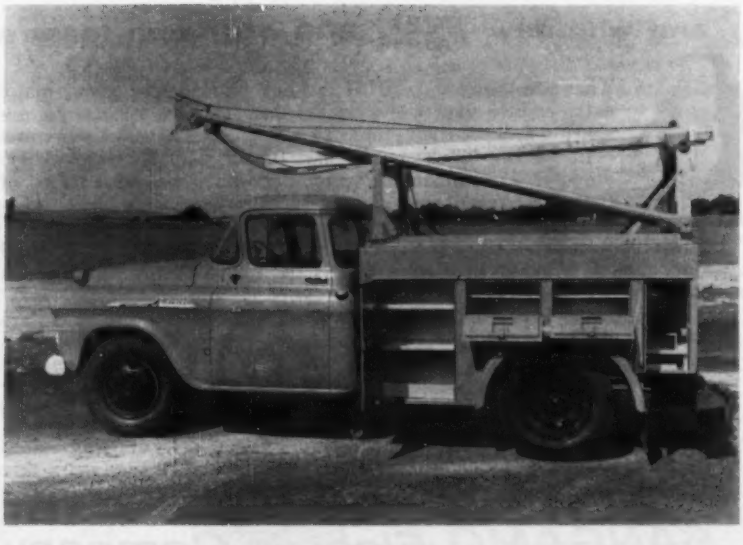


Capacitor Mount . . .

. . . in pre-wired, 12-unit equipment handle up to 600 kvar with ratings through 7,960 v. Designed for ease in installation, this pole-top equipment is mounted with compression-type bracket that obviates through bolts. Perfect balance keeps pole bending moment to a minimum. Additional features include free climbing space in excess of 33 inches, readily accessible oil switches, and an adjustable kicker bracket for easy leveling after installation.

Sangamo Electric Co, Springfield, Ill.

Combination Body...



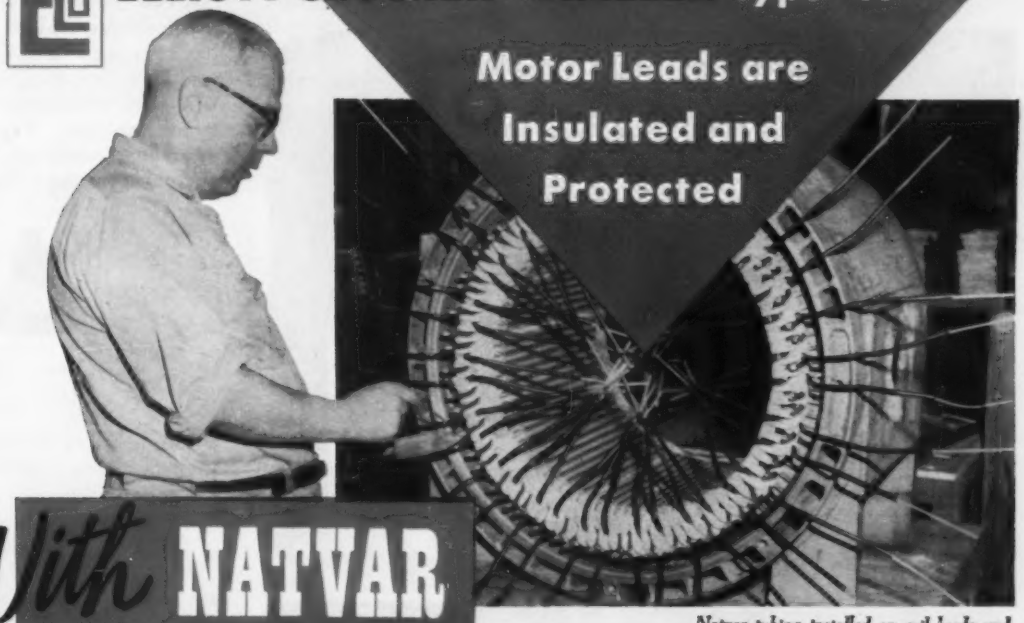
. . . for light line work, maintenance, and general service is durable and flexible. Side compartments and understructure are galvannealed steel. Unit has steel tread plate floor, with tread plate extending full length at top of each side box. Compartments include tunnel for extended winch shaft, pull-out drawers, divided bins, water cask, and tunnel for long tools. This Model 5696 body can be used on one to 1½ ton chassis with dual rear wheels and 60-in. cab-to-axle dimension. Optional equipment includes 24-ft extension ladder, collapsible power reel; derrick equipment.

York-Hoover Corp, York, Pa.

(*More New Equipment on page* 112)

ELLIOTT CROCKER-WHEELER Type "N"

Motor Leads are Insulated and Protected



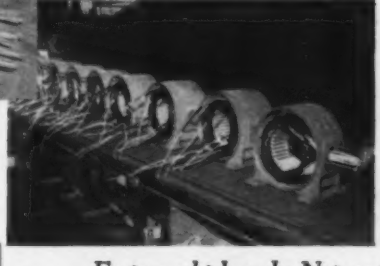
With **NATVAR**

Natvar tubing installed on coil leads and connectors of a larger a-c motor.

VINYL COATED FIBERGLAS TUBING

Natvar vinyl coated fiberglas tubing, as applied to these a-c field coil leads, gives ample electrical protection and flexes easily.

▼ *Line-up of NEMA frame motors with Natvar tubing applied to coil leads.*



The Crocker-Wheeler plant of Elliott Company builds a wide variety of electrical motors in sizes up to 200 hp. Natvar vinyl coated tubing is widely used on Crocker-Wheeler a-c induction motors in both large and small ratings.

Factors which make Natvar tubing especially suitable for the protection of motor coil leads and connectors are its uniformly high dielectric value, mechanical strength, resilience, and resistance to cold flow. It is used in both Class A and Class B insulated machines.

If you need insulating materials with good physical and electrical properties and exceptional uniformity, it will pay you to get in touch with your distributor or with us direct.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Abeglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated—varnished tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 24

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

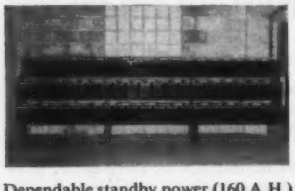
TELEPHONE FULTON 8-8800

CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

Here in a new substation just north of Tulsa, as in many other locations, the Public Service Company of Oklahoma uses C & D PlastiCell batteries as an always-dependable source of power for switchgear control. By opening and closing circuit breakers, operating pilot lights and control relays, C & D PlastiCell batteries help keep vital switchgear equipment on the job.

Just as the Public Service Co. of Oklahoma has found C & D PlastiCell batteries to be specifically designed and engineered for control service, you'll find they'll meet your every need for all control, switchgear and auxiliary power needs. In C & D PlastiCell batteries you get:



Dependable standby power (160 A.H.) is provided by this C & D 60-cell PlastiCell battery.

- **Long life** due to exclusive suspended and supported plate construction; extra-thick, triple insulated plates.
- **Low in-space cost** because plastic jars are lighter, break-resistant and require less space.

Write for descriptive literature on C & D PlastiCell batteries.

*Trademark

C&D BATTERIES, INC.
of Conshohocken, Pa. ... Attica, Ind.

Since 1906
Sales and Service Offices in Principal Cities from Coast to Coast

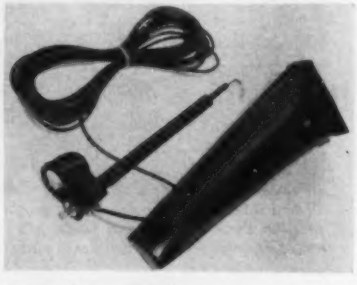
Manufacturers of Dyn-Cel ® Industrial-Batteries • PLASTICELL and PLASPOWER ® Batteries for Communications, Control and Auxiliary Power • Producers of Autolay • Silicon Chargers

Mid-Span Wedge Clamp . . .

. . . can connect up to four Triplex house service neutrals. Unit is one-piece design, with all cable entrances heavily flared. Massive, one-center-bolt type connector attaches unit to neutral main. Taps are "pulled in" around wedge arc and released. Tap cable wedges down into tapered

groove which holds it to its ultimate strength. Hex head bolts position the end of the tap cable. Clamp main accommodates No. 4 ACSR to 2/0 ACSR; tap grooves, No. 6 solid to No. 2 ACSR. Tap wedge-arc take-off groove accommodates 80-deg horizontal angle and 15 to 45-deg vertical angle.

Anderson Electric Corp, Birmingham 1, Ala.



High Line Voltmeter . . .

. . . measures voltages up to 15 kv safely and easily in either wet or dry weather. Standard hot stick with tapped head attaches to Safety Voltmeters base stud. Two scales, zero-5 kv and zero-15 kv, can be read at 8-ft distance. Instrument consists of test prod, series resistance, indicating head, and 20-ft ground lead. Test prod may be any size or shape to meet user's requirements. Peak voltage rating is 75 kv. Current to ground is 0.6 ma at 15 kv; 0.2 ma at 5 kv. Instrument weighs 2-¼ lb and comes with leather carrying case.

Western Electro-Mechanical Co, Inc, 300 Broadway, Oakland 7, Cal.

(*More New Equipment on page* 114)

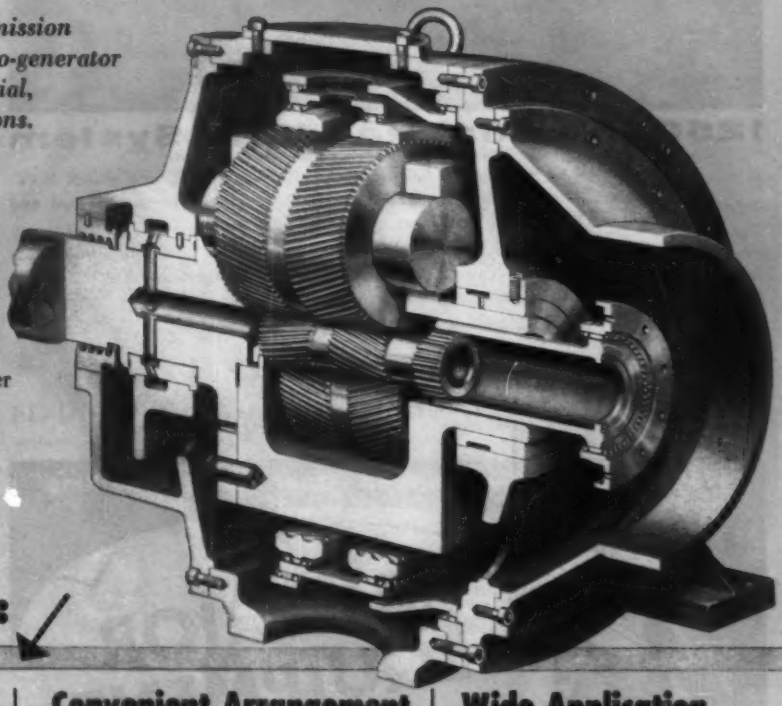
DE LAVAL-STOECKICHT
PLANETARY GEAR

...*for high speeds...high horsepower*

Proved in hundreds of installations abroad totalling over 3,000,000 horsepower—now available in America!

For all high torque power transmission applications such as pump turbo-generator and compressor drives in industrial, municipal and marine installations.

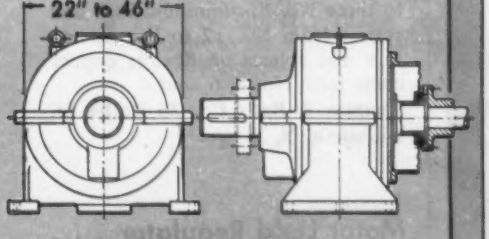
This cutaway view of the De Laval-Stoeckicht Planetary Gear shows how it provides flexibility for proper load distribution throughout the gear members. The thoroughly proved and tested design is completely reliable in transmitting high horsepower for high speed applications. • Highest efficiencies (98% or higher)...no high speed bearings...less friction losses.



Check These Advantages:

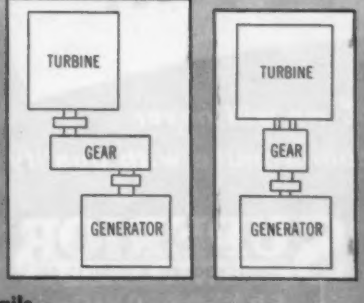
Small Size—Light Weight

Compact—low weight per hp. Sizes range from 22" to 46" in diameter, depending on horsepower requirements. Example: 5000 hp planetary unit weighs 1700 lbs. against 6000 lbs. for conventional gear.



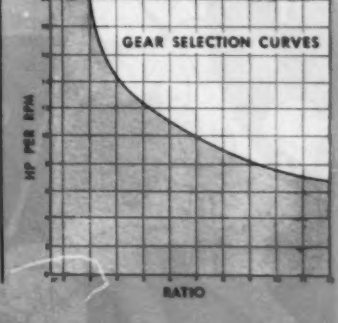
Convenient Arrangement

Co-axial or "in-line" arrangement of gear members takes up far less space than parallel axis gears of equivalent horsepower rating.



Wide Application

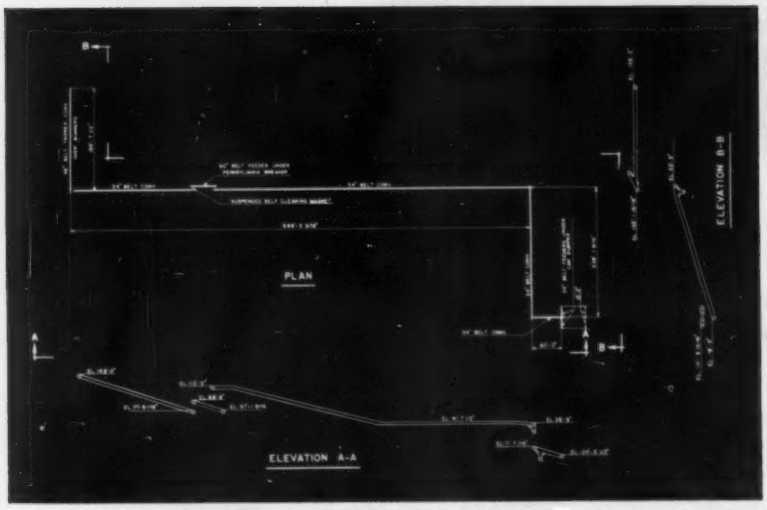
Capacity range shown in shaded area on chart below. For other applications, contact your De Laval Sales Engineer.



For further details, write for Bulletin 2400.

DE LAVAL *Steam Turbine Company*

861 Nottingham Way, Trenton 2, New Jersey



1250 tph Coal Handling System

A Reputation for Dependability is our most valued Possession

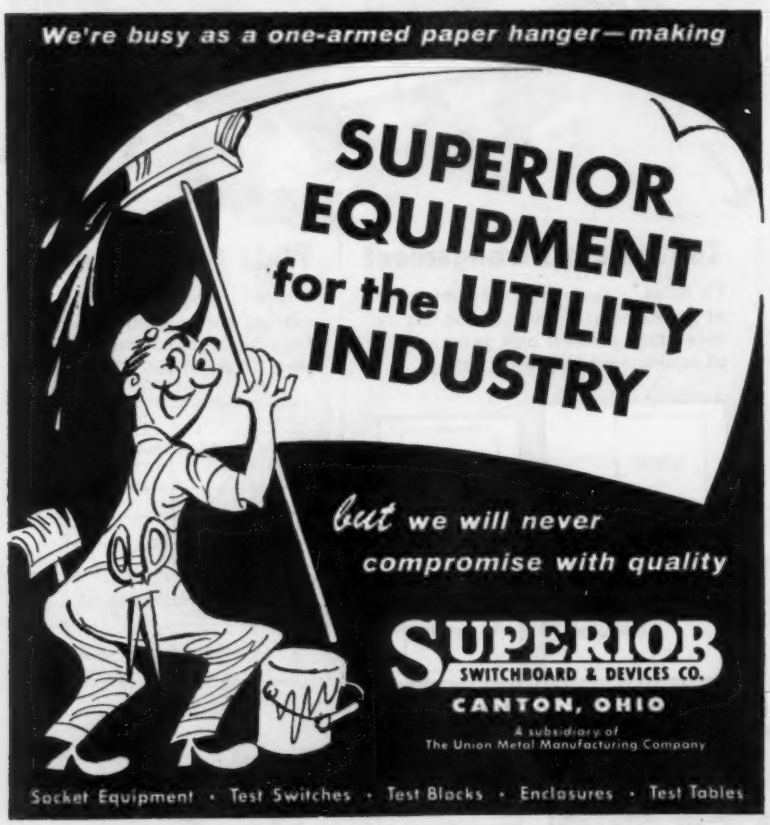
The new Arthur Kill Station of Consolidated Edison Co. of N. Y. Inc., is now being equipped with a coal-handling system designed and built by Sy-Co Corporation.

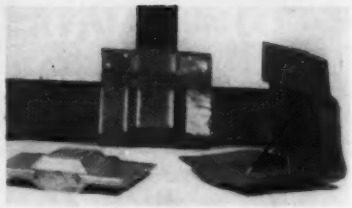
Bulk coal handling problems are solved by Sy-Co through the knowledge and skill acquired in solving similar problems for some of the largest firms in the country.

Please address your inquiries to:

SY-CO CORP.

P. O. Box 242, Paramus, New Jersey COlfax 1-1414

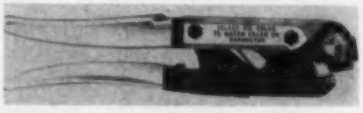

We're busy as a one-armed paper hanger—making
SUPERIOR EQUIPMENT for the UTILITY INDUSTRY
but we will never compromise with quality
SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company
Socket Equipment · Test Switches · Test Blocks · Enclosures · Test Tables



Bus Splice Cover . . .

. . . of flame retardent insulation is now a feature of 4.16-kv metal-clad switchgear. Replacing the molded splice covers and potting compound previously used, it simplifies customer installation of bus ducts and switchgear which are shipped separately. Made of polyvinyl-chloride, the cover has 60-kv BIL rating, is flexible, and easily handled. This cover is available in sizes and shapes to insulate 1,200- to 2,000-amp bus with or without take-off connections.

General Electric Co, Schenectady 5, N. Y.



Hand Installing Tool . . .

. . . has built-in rotating die. Known as the TBM-2, it has dies color-keyed to match the corresponding connector size. Proper die is selected by rotating the die to the color matching the connector to be installed. The tool provides a connection with low resistance and high pull-out value. It can not be removed from the connector until compression is complete. This tool will install lugs and splices on code copper cable from No. 8 to No. 2; copper pigtails from three No. 12 to three No. 8; aluminum lugs and splices from No. 12 to No. 6; and lugs and splices on flexible copper cable from No. 8, 6, and 4.

Thomas & Betts Co, 36 Butler St, Elizabeth, N. J.

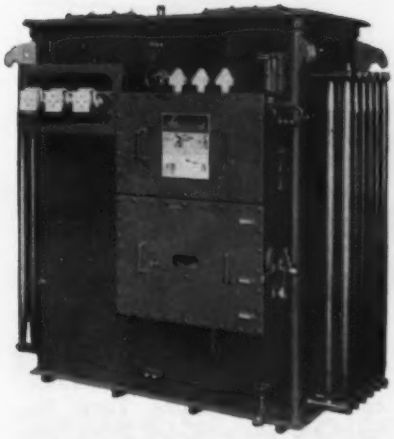
Motor Load Regulator . . .

. . . has selection of specially sized cams for automatic set point adjustment in controlling a-c motors and loads. Applicable to compressors,

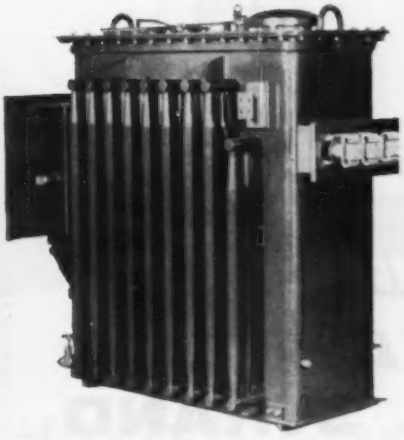
(*Continued on page* 116)

Six week delivery
Designed to your specs
Incorporates your components
Exceeds all NEMA standards

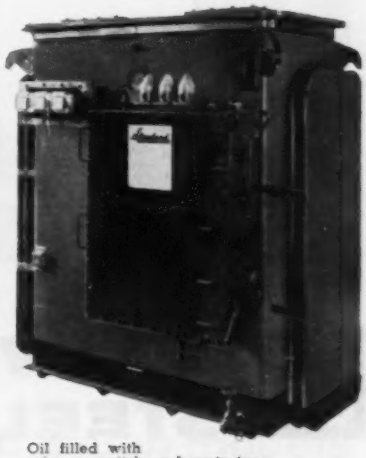
LO-TEMP*
NETWORK TRANSFORMERS
...ALL THE SAME BUT EACH DIFFERENT



Oil filled with primary switch and protector type throat on one side instead of opposite ends to permit installation in an existing vault.



Askarel filled with usual arrangement of high and low voltage terminations for installation in a limited space.



Oil filled with primary switch and protector type throat on one side with "pancake" type radiators to permit ease of cleaning and maximum cooling.

You pay no premiums, select your own components and get your network transformers designed to your specifications in less time at Standard. The three units illustrated point up the need for transformers DESIGNED for the duty they perform. Each unit has the same basic design and performs the same basic duty in a network system . . . BUT THEY'RE ALL A BIT DIFFERENT. These variations permit these units to be used in existing locations and utilize existing circuits.

There are extra benefits in Standard's LO-TEMP units. They have ample steel and ample copper that give you extra capacity at no extra cost. Extra capacity adds up to longer life and no service interruptions. These are the considerations that mean added revenue to you.

Get the facts on Standard's LO-TEMP Network Transformers from your nearby Standard representative today. He'll show you, in dollars and cents, how you can get premium transformers at off-the-shelf prices.

** Standard LO-TEMP Transformers provide extra capacity at no extra cost.*

Standard Transformer CO.
WARREN, OHIO

LIVE BETTER ELECTRICALLY

Phone 2-1563

"WHEREVER THERE IS POWER"

What a line...

CF&I GALVANIZED STEEL STRAND

Where overhead distribution lines must cover long spans, or in areas where high velocity winds and adverse weather impose a severe strain on power poles, dependable guying is a must.

To provide safe installation and long, trouble-free service life, ground crews prefer CF&I Galvanized Steel Strand. It is made of steel with exactly the right chemical and physical properties to assure high strength and easy workability. The wire is carefully drawn, stranded, cleaned and galvanized with a tightly-bonded coat of pure zinc to produce a corrosion-resistant finish that won't flake, even when severely bent.

CF&I Galvanized Steel Strand meets or exceeds ASTM Specification A-122 or A-363, and is made in a seven- or three-wire construction to meet your specifications. Your nearby CF&I representative or local electrical distributor can give you complete details. Call him today.

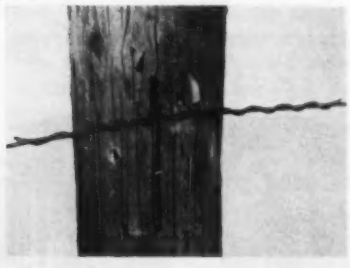
CF&I GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver El Paso • Ft. Worth • Houston • Kansas City • Lincoln • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia
CF&I OFFICES IN CANADA: Montreal • Toronto • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton Vancouver • Winnipeg
5904-A

Regulator

(*Continued from page* 114)

blowers, pulverizers, exhausters, and other motor loads in 5 to 10,000 -hp range, this unit measures and converts current flow to pneumatic signal. Unit is nominal 5-amp device, with accuracy of ±0.1 amp and repeatability better than 0.05 amp. Cam in the set point mechanism can be shaped and sized to match specific process requirements.
Hagan Chemicals & Controls, Inc, P. O. Box 1346, Pittsburgh 30, Pa.



Tangent Supports . . .

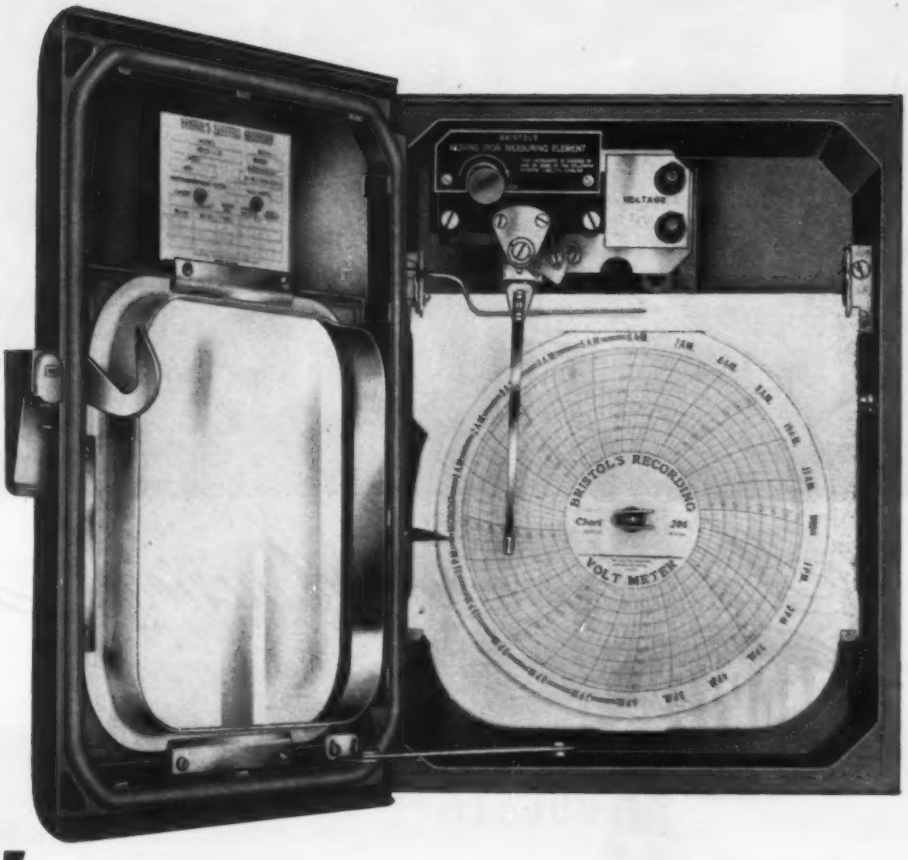
. . . with extra heavy neoprene coating are preformed for "C" rural one pair distribution wire. Combination of stainless steel core and protective cushioning assures low, uniformly distributed radial pressure over entire holding area without injurious concentrated pressures. These fittings are available for 2-No. 14, 2-No. 12 Copperweld "C" rural conductors, and 2 No. 0.083 galvanized steel.
Preformed Line Products Co, 5349 St Clair Ave, Cleveland 3, Ohio

Force Balance Transmitters

. . . measure and pneumatically transmit flow, level, differential pressure, and specific gravity over wide ranges. Minimum range span is from zero-2 inches of water under service pressures up to 50 psig; maximum range span is zero-2,000 inches of water under service pressures to 5,000 psig.

Known as f/b-Line transmitters, they are available with three standard measuring diaphragms to cover all ranges.
Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland, Ohio

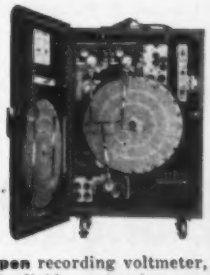
(*See Reader Service, p.* 120)



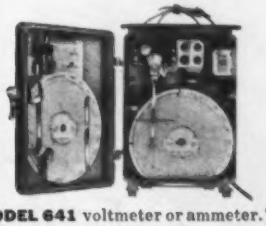
BRISTOL single-pen recording voltmeter for permanent surface or flush-panel mounting. Available for conduit or open terminal connections. Also made in portable and pole-mounting models.

NOW!

Series 500 voltmeters in 1-, 2-, and 3-pen models



New Bristol 3-pen recording voltmeter, portable model, features proved reliable moving-iron measuring elements. Ideal for checking balance in 3-phase systems.



BRISTOL MODEL 641 voltmeter or ammeter. This extra-compact folded-chart portable instrument is a favorite with utility men. 1- or 2-pen types only.

Bristol's recording voltmeters can now have as many as three independent moving-iron elements. Similar ammeters available

Rugged, precise (±1%) Bristol recording voltmeters are now available to record up to three independent voltages on a single chart.

The new 3-pen voltmeter uses the same durable, precise moving-iron elements tried and proved in Bristol single-pen and two-pen voltmeters. And like these field-proved Bristol instruments, the new 3-pen voltmeter comes in types for portable, portable and pole mounting, or wall, switchboard or flush-panel mounting. Single or double range. Check these outstanding features.

High Accuracy — ±1% of full scale.

High-torque moving-iron mechanisms — produce greatest torque possible, keep weight and power drain to minimum, assure positive recording over full range.

Low electrical burden — 5.5VA at 120V or 12VA at 240V for each mechanism.

High stability of calibration — seldom requires calibration.

Easy calibration in field — no special tools or skills required.

Rugged construction — shockproof bearings, pen locking device for shipping or carrying portable models.

Leveling not critical

ASA models available — to specification C39.2–1953.

Write for complete data on Bristol 1-, 2-, or 3-pen recording voltmeters. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

BRISTOL TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Introducing to American Industry...

MARLEY MOUCHEL **HYPERBOLIC NATURAL**

The Marley Company, in association with L. G. Mouchel & Partners, engineers, London, presents to American industry the reinforced concrete HYPERBOLIC NATURAL DRAFT COOLING TOWER — a different concept in large-volume water cooling. New to this continent, Mouchel has a record of 35 years of successful service in over 500 installations in many countries. The universal success of these installations has firmly established the Mouchel organization as the world's outstanding designers.

These towers bring to the power industry established standards of durability and low operational expense that qualify them as most important in the economic pattern of 100-megawatt and larger plants that are now in the plan stage for tomorrow's power demands. These outstanding advantages are distinctive to the Marley-Mouchel cooling tower:

The plant designer has complete freedom in location of the tower to conserve plant area and piping. Hyperbolic Natural Draft Towers may be placed near the machines they serve since ground fogging and recirculation of warm, moist vapor do not occur.

No fans—no horsepower is required. Thermal power created by heating and humidifying the air is the only energy used. A valuable part of the plant's production is thus conserved for salable transmission.

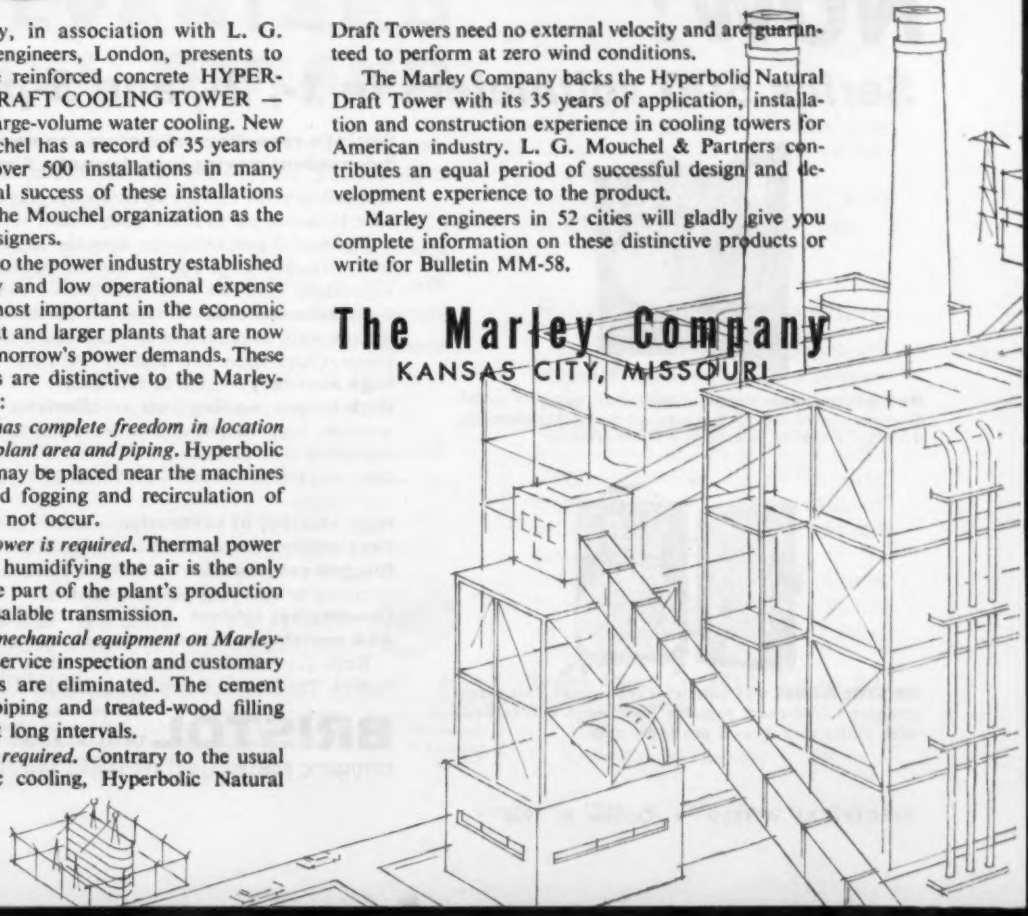
There is no moving mechanical equipment on Marley-Mouchel towers. Daily service inspection and customary maintenance schedules are eliminated. The cement asbestos distribution piping and treated-wood filling need inspection only at long intervals.

No wind velocity is required. Contrary to the usual theory of atmospheric cooling, Hyperbolic Natural Draft Towers need no external velocity and are guaranteed to perform at zero wind conditions.

The Marley Company backs the Hyperbolic Natural Draft Tower with its 35 years of application, installation and construction experience in cooling towers for American industry. L. G. Mouchel & Partners contributes an equal period of successful design and development experience to the product.

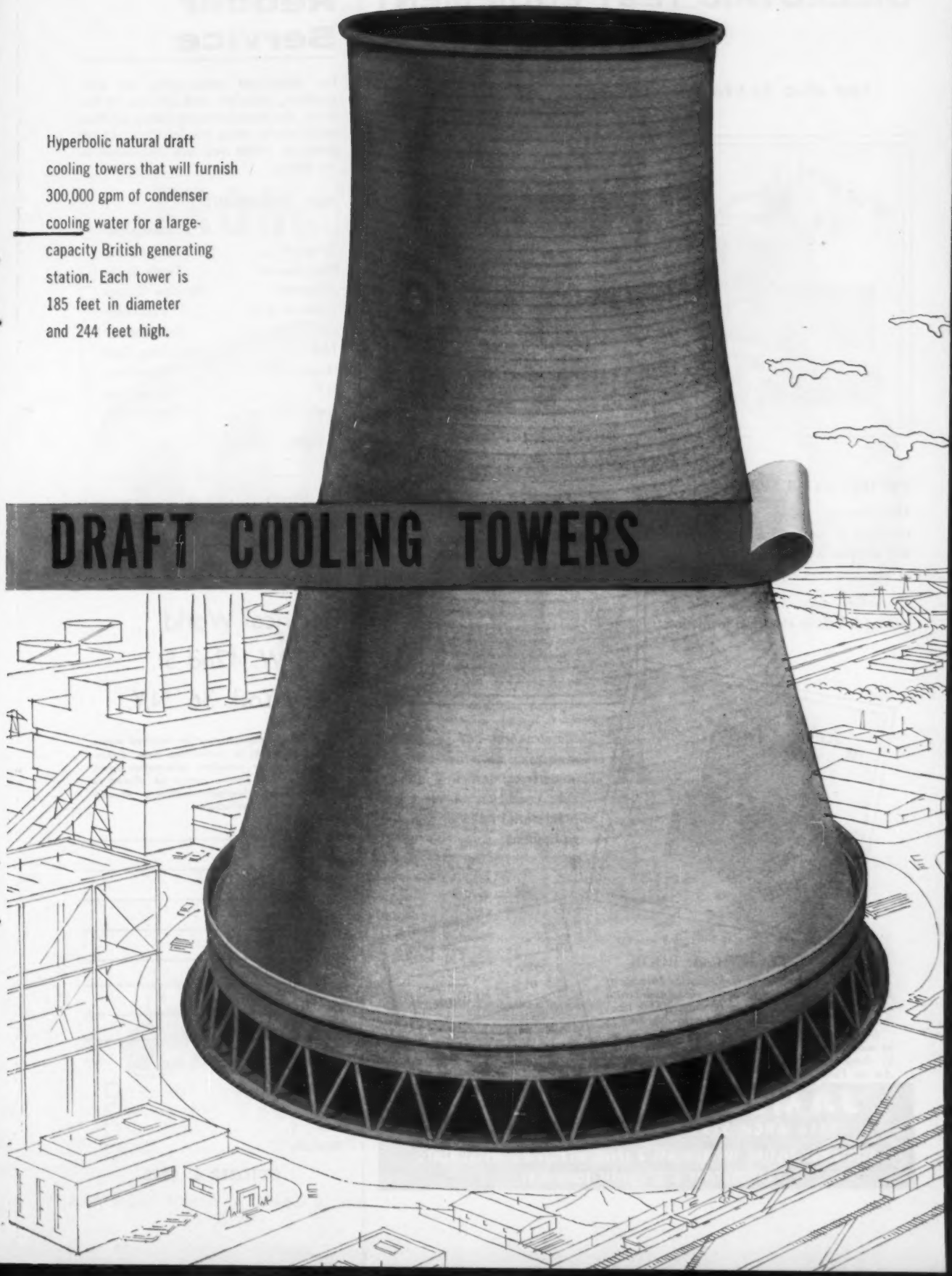
Marley engineers in 52 cities will gladly give you complete information on these distinctive products or write for Bulletin MM-58.

The Marley Company
KANSAS CITY, MISSOURI



DRAFT COOLING TOWERS

Hyperbolic natural draft cooling towers that will furnish 300,000 gpm of condenser cooling water for a large-capacity British generating station. Each tower is 185 feet in diameter and 244 feet high.



DIELECTRIC TEST EQUIPMENT *by* BIDDLE

...for d-c tests at voltages up to 100 KV

IMPORTANT FEATURES

- Well-designed provisions for utmost safety
- Simple operation and reliable performance
- Excellent output voltage regulation
- Compact, mobile design
- Facilities for voltage and leakage current measurements

IMPORTANT USES

Development—to test d-c dielectric strength of insulating materials and the adequacy of the electric design of insulation in equipment.

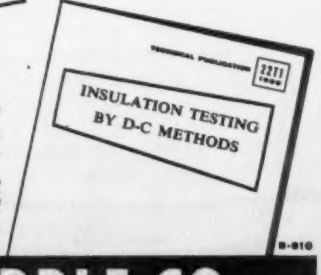
Production—for non-destructively detecting defects in electrical insulation.

Maintenance—and preventive maintenance—for non-destructively detecting unreliable condition of electrical insulation in new or repaired equipment.

NEW TECHNICAL BOOK

A new technical treatise by E. B. Curdts, Director of Engineering, James G. Biddle Co., contains a wealth of pertinent data for the engineer interested in insulation maintenance of electrical equipment.

Copies are available at $2.00 each. Orders should be made on your company's letterhead accompanied by check to the order of the James G. Biddle Co. Ask for Publication 22T1W.



JAMES G. BIDDLE CO.

1316 ARCH STREET • PHILADELPHIA 7, PA.

ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS
LABORATORY & SCIENTIFIC EQUIPMENT

Reader Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

I-T-E	Substations ☐
Sangamo	Capacitors ☐
York-Hoover	Truck Body ☐
Anderson	Wedge Clamp ☐
Western E-M.....	Voltmeter ☐
GE	Transformer ☐
T&B	Installing Tool ☐
Hagan C&C	Regulator ☐
PLP	Supports ☐
Bailey Meter.....	Transmitters ☐

OTHER

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Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* **Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.**

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TITLE_____

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DEPT._____

COMPANY_____

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FOR:

Reference	☐
Specs	☐
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OCTOBER 6, 1958

NEW FROM VICTOR!

NO. 961 FOGBOWL SUSPENSION

Specially designed for fog and smog contaminated areas, this brand new product of VICTOR research was created to satisfy a critical need. The new No. 961 suspension has the *lowest* leakage current and the *lowest* radio interference level of any other type or make of fogbowl suspension insulator used in contaminated areas.

Low surge and leakage currents contribute to many desirable advantages of this insulator—particularly the elimination of wood cross-arm burning. These exceptional features have been proved not only in VICTOR'S own electrical laboratory, but by extensive service on lines in locations where contamination is a serious hazard.

If your service depends on protection against fog, smog and industrial contamination, here is your answer—VICTOR'S new No. 961 Fogbowl Suspension. You can't buy better—at any price!

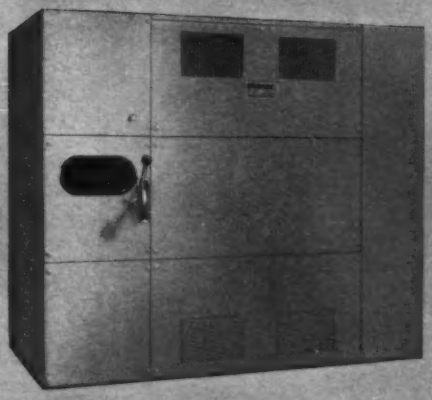
VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC. • VICTOR, N.Y.

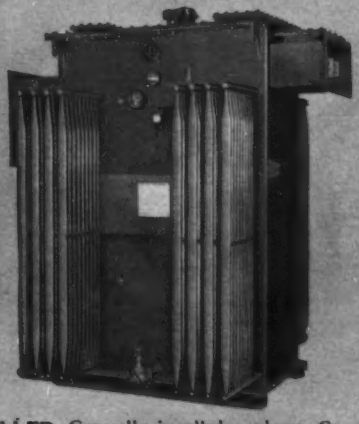
Wagner

UNIT SUBSTATION TRANSFORMERS

112½ to 2000 Kva—three phase, 60 cycles, 15 KV and below



VENTILATED DRY-TYPE—For indoor installation in reasonably dry, dust-free, well ventilated locations. Light in weight, ideal for multi-story buildings. No fire-proof vaults required. Insulated for 80°C temperature rise.

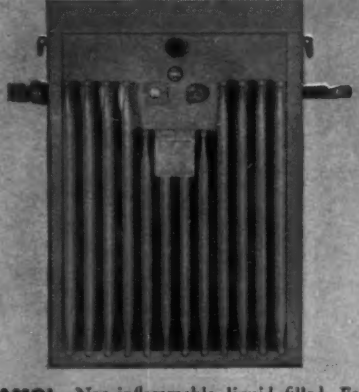


OIL-FILLED—Generally installed outdoors. Can be used indoors in fire-proof vaults. Outdoor transformers can be connected to indoor switchgear using weather-proof bus-duct. 55°C rise, self-cooled or forced-air cooled.

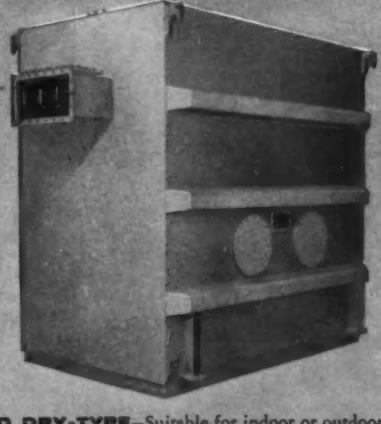
When you select a Wagner Transformer...

YOU GET THE TYPE FOR YOUR PLANT

PLUS... the assurance of continuous,



NOFLAMOL—Non-inflammable liquid filled. For indoor or outdoor installation, especially suited for chemical plants, refineries and similar locations where explosive liquids or gases are present. The close-coupled design illustrated fits flush against switchgear enclosures. Throat connected designs are also available. 55°C rise, self-cooled or forced-air cooled.



SEALED DRY-TYPE—Suitable for indoor or outdoor use, completely fire-proof, easy to clean and maintain. Sealed tank is filled with nitrogen under low pressure. Insulated for 150°C rise, self-cooled.

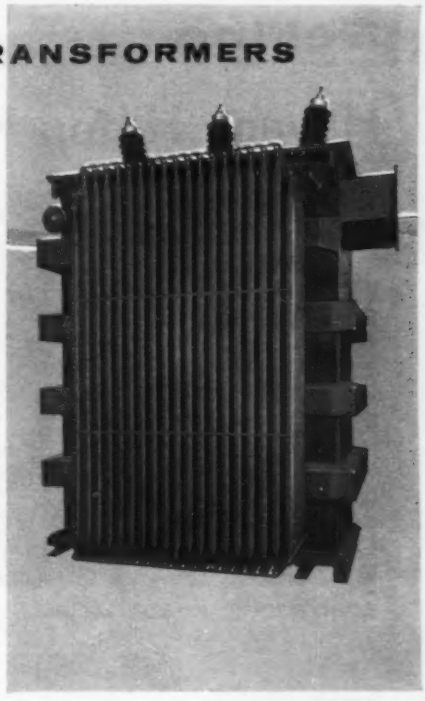
WAGNER ELECTRIC CORPORATION

WT58-16

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Wagner **INDUSTRIAL POWER TRANSFORMERS**

Oil-filled, through 10,000 Kva, 67 KV and below.
Noflamol, through 7,500 Kva, 15 KV and below.



BEST SUITED ELECTRICAL SYSTEM . . .

dependable service!

If you are planning a new plant distribution system . . . modernizing your present one . . . or adding to its capacity to meet increasing demands for power . . . it will pay you to specify Wagner Transformers.

For your main plant substation, Wagner Liquid Filled Industrial Power Transformers are available in standardized ratings through 10,000 Kva.

For your load centers, Wagner can supply Unit Substation Transformers in any of the types shown at the left, furnished with suitable incoming line sections, to meet your particular requirements. These PREDESIGNED transformers will save you time and save you job engineering costs. You can specify the secondary switchgear you prefer.

For plant areas requiring 120/240 volts, single-phase or 208Y/120 volts three-phase, Wagner Dry-Type Distribution Transformers are an economical choice.

All Wagner Industrial Transformers are liberally designed, sturdily constructed, thoroughly tested and able to meet the heaviest industrial demands. They assure continuous, dependable power for years to come.

For expert advice on your present and future plant transformer needs, call or write the Wagner branch near you.

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner **DRY-TYPE DISTRIBUTION TRANSFORMERS**

Single-phase 1 to 100 Kva—Three-phase 3 to 300 Kva—600 volts and below

Type AE, single-phase, 1 through 50 Kva, and Type AP, three-phase, 3 through 30 Kva, can be used for indoor or outdoor installation, larger ratings for indoor installations only. Ratings through 10 Kva single-phase and 30 Kva three-phase are designed for wall mounting, other ratings for floor or platform mountings.

Available for high voltages of 120 X 240, 240 X 480, 480 and 600 volts to 120/240 volts single-phase, and 480 and 600 volts to 208Y/120 volts three-phase.

Havana Hilton Hotel Kitchens Go All-Electric

EIGHT ELECTRIC RANGES with ovens, two broilers, two fryers and three salamanders have 231.6-kw load.

TOTAL LOAD for bake oven with two sections, one with three sections and one electric range is 52 kw

TWO ELECTRIC RANGES with ovens and one bake oven with two sections have 54.4 total load

Thirty-eight pieces of electric cooking equipment installed; chefs sing its praises. Total load is 642.4 kw

The large, luxurious Havana Hilton Hotel in Havana, Cuba, is living better electrically. Electric cooking equipment has been installed in the kitchens. Compania Cubana de Electricidad is the utility which serves the hotel with power.

Equipment installed includes: 20 heavy-duty ranges with ovens, 6 broilers, 4 fryers, 5 salamanders, 2 two-section and 1 three-section bake ovens. Total cooking connected load is 642.4 kw. The equipment was sold by the Hotpoint Co through International General Electric.

And the chefs love it! Listen . . .

"I am completely satisfied with the results that we have obtained with the electric ranges, the ease with which they are controlled, their cleanliness, and coolness. They make our work very pleasant."—Executive Chef John Schaerer.

"I have always used electric ovens and I was pleased to see that the Havana Hilton also had installed them. All my assistants are very glad to work with this type of equipment because of the precision with which we can control temperature, and the clean, comfortable atmosphere we all enjoy."—Paul Mathys, Pastry Chef.

Range and Water Heater Campaign

A 3½-month residential electric range and water heater campaign netted dealer sales of 2,560 electric ranges and 2,034 water heaters for the Cuban utility. Distributors were offered $30 wiring allowance for every range sold by them or their dealers. The company reports that although some range installations cost as much as $100 the over-all average is about $40 and most distributors felt they could assimilate the difference. However, they stipulated that the free wiring should be limited to 50 ft from the meter.

The company credits its successful campaign to the wiring allowance, and to advertising. Radio, TV, movie shorts, newspapers, magazines, posters and billboards plugged modern, faster, cleaner, safer electricity, and the fact that "these conveniences should be enjoyed in every Cuban home."

Pleased with the results, the company extended the wiring allowance to every range sold this year.

The company's expansion program calls for it to double its present generating capacity by 1961. A total of $149 million had already been spent on new construction in the 10-yr period, 1948-1957. At the end of 1957, its generating capacity was 361,550 kw, with total sales for the year of 1,282,119,000 kwhr, and a total of 704,155 customers.

(*More Selling on page* 127)

ARBUCKLE GENERATING STATION
OKLAHOMA GAS AND ELECTRIC COMPANY
78,000 kw—1 Unit

Power in Oklahoma...

Oklahoma Gas and Electric Company's faith in the commercial and industrial development of Oklahoma is shown by the fact that approximately 500,000 kw of new generating capacity in both indoor and outdoor plants has been placed in service since 1953, anticipating increased demand. In addition, a 240,000 kw unit is now under construction and will be the largest in the system. It is designed for 2000 psig, 1000 F, reheat 1000 F, and is being installed near Oklahoma City.

FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

140 SOUTH DEARBORN STREET, CHICAGO 3, ILLINOIS

Power Boost with **PARANITE®**

Consolidated Edison is meeting the challenge of mounting demands for electrical power with a systematic program of replacement and expansion. Selected to help carry this ever-increasing load in the Metropolitan New York area is Paranite "Network Power Cable" . . . one of the many Paranite products which backs up a reputation . . . "IF IT'S PARANITE IT'S RIGHT®"

Why PARANITE "NETWORK CABLE?"

Paranite Network Cables are engineered, manufactured, tested and have been proven in installation to meet the severe demands of seasonal peak loads. The consistent performance of Paranite marks it as a product of close quality control!

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

Sales Offices in all Principal Cities

LIVE BETTER ELECTRICALLY

Street Lighting for Small Towns–It Sells Itself

EDWIN B. CURRAN, Lighting Specialist, The Connecticut Light & Power Co, Waterbury, Conn.

Many of us concerned with street lighting sales, I know, are missing a tremendous potential due to our sales approach. Most of us admit, much as we dislike, that when the annual town budget is compiled, very often the appropriation for new street lighting is either "token" or nonexistent.

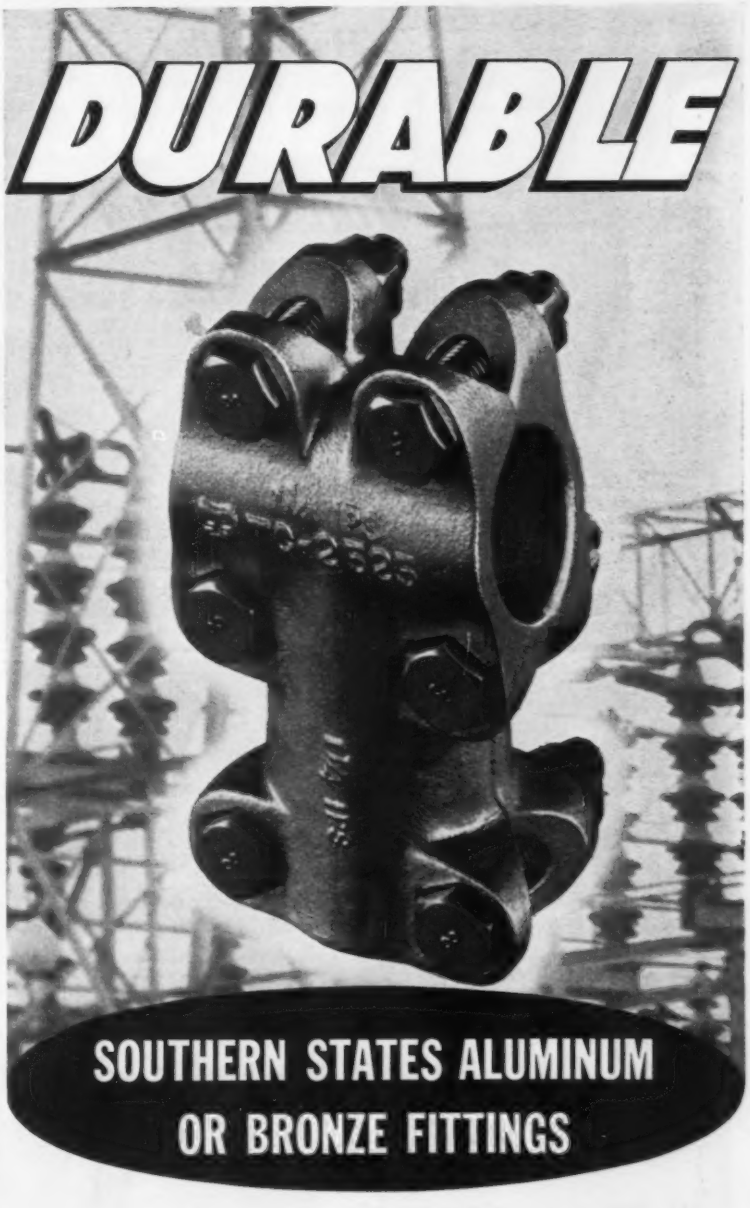
While personally 100% in accord with code lighting presentation, and all it encompasses—code traffic density maps, fatality locations, areas of high crime, etc.—I firmly believe that such a survey should be restricted to cities, unless specifically requested by town officials. It has been my experience that, in many cases, a complete code survey of a small town usually results not in an order, but in the survey being "tabled."

The reasons for this are many; primarily, of course, is the monetary consideration. Code lighting, especially where there is little if any lighting can be very expensive when presented as a "package."

Rather than take an entire community, choose one or two main streets and work from there. The reasons for this are obvious. The town officials are not overwhelmed, the budget is not overextended, and, last but not least, one code-lighted street will gradually multiply into two, and on and on until the job is completed.

Selling modern street lighting to officials of small towns is, it seems to me, exactly like selling anything else. You give the prospect several alternatives from which to choose, and he invariably reacts favorably. "Would you like street 'X' relighted this fall, or would street 'Y' be a better one to tackle first?" He then is induced to make a choice; not whether he *will* have modern street lighting this fall, but *which one* he wants. He is not overwhelmed by a yes or no decision as to the adoption of an expensive program. His choice of several alternatives completely eliminates the "yes-no" decision. He responds favorably to the "which do you want" psychology.

(*Continued on page* 128)



Knowing that fittings are often re-used, Southern States has designed its entire line with easy, on-the-job assembly and re-assembly foremost in mind. Southern States connectors and bus supports have recessed hexagonal bolts, assuring easy and rapid "one-wrench" installation or removal. Each connector fits properly, has ample strength, and is sufficiently rugged at stress points. *Never underestimate the importance of a good connection!*

SS SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Here's Why

GAI-TRONICS

Transistorized

COMMUNICATIONS

IS "TOPS"

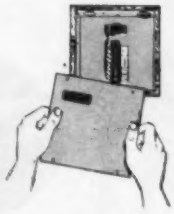
in *maintainability*

GTC

*an effective, economical industrial communication system designed to provide swift and sure voice communications regardless of distance or surrounding noise conditions.

1. Central control cabinet is eliminated.

2. Loudspeaker Amplifiers and Handset Stations are "plug-in". Untrained personnel can replace a defective unit with a "spare" in minutes. Repairs can be made at the shop bench.



3. The inconvenience and expense of vacuum tube failure is completely eliminated. Unlike vacuum tubes, transistors indicate unlimited life and no deterioration in operation.

4. Because of transistors' much lower voltage requirements, GTC operates with much greater safety factor than vacuum tube equipment.

5. Ultra-simple wiring plan (no shielded cables used).

GAI-TRONICS
CORPORATION
Dept. A
READING, PENNA.

A SUBSIDIARY OF GILBERT ASSOCIATES, INC., ENGINEERS AND CONSULTANTS

GTC is extremely flexible in application. Write today for a copy of our completely illustrated, descriptive booklet. It's yours free by return mail.

Street Lighting

(*Continued from page* 127)

After this, the rest is relatively easy. Home-owners on neighboring streets see to that!

And the results? Code lighting is accomplished much sooner, with excellent town acceptance, and greatly improved relations with the officials. In fact, I've gained the impression that they almost enjoy talking over their street lighting problems. When a town selectman makes a choice it's his decision—not mine. He likes it that way.

Pastel Colors Used in New Lighting System

A lighting system for stores, hotels, offices, etc which reportedly provides between 100 and 250 ft-c and uses pastel-colored panels for decorative effect has been developed by Silvray Lighting Inc, Bound Brook, N. J. Called Colorceil, the system is done by arrangement of two-lamp units and the use of three different types of high intensity fluorescent tubes, including GE's new Power Groove lamp. The lamps may be used individually or in combination.

Design effects are obtained in two or more colors (yellow, pink, blue, green, and white are available) by dropping in "floating" plastic egg-crate panels in desired colors in the lamp units, spaced two ft apart.

Dryer Campaign Features 'No Haul' Theme

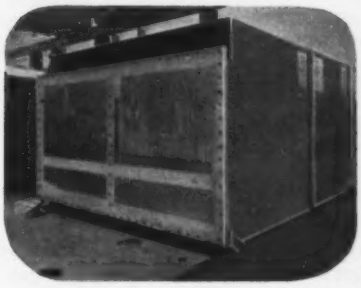
"No Heave . . . No Haul . . . No Hang" will be the message put before New York housewives in October and November by Consolidated Edison Co of New York. It's part of an automatic clothes dryer promotion which will include advertising in all media.

A special promotional mailing to 250,000 homes will offer a gift to housewives who visit their local appliance store for a dryer demonstration. A booklet answering the questions most asked about clothes dryers will also be offered. Seventeen appliance manufacturers plan to participate.

(*More Selling on page* 130)

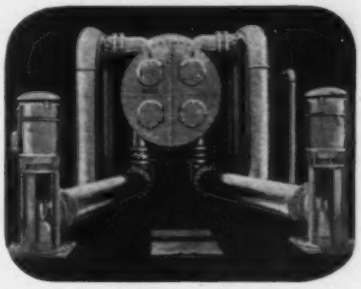
and auxiliary equipment

HOW C.H. WHEELER CONDENSER DESIGN saves space...



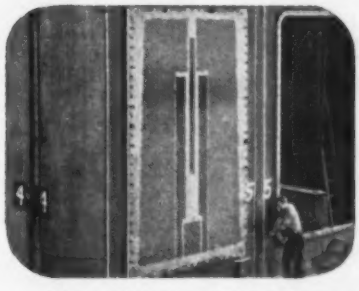
Head Room problems are solved by compact condensers like this one. Turbine floor to basement floor, in this case, is only 20 ft. The Unit has 65,000 square feet of condensing surface.

Rectangular Cross Section makes C.H. Wheeler Condensers adaptable to nearly any space or condenser arrangement because the length, width and height of any Wheeler Unit can be varied almost at will.

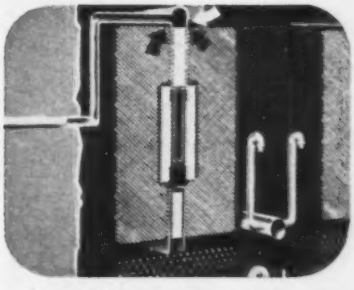


But Wheeler Doesn't limit itself to rectangular design. A round cross section worked out better here, for example, at the first planned gas-steam turbine station ever designed and built in United States.

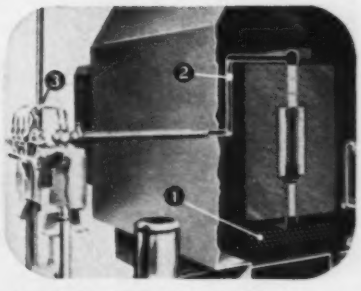
improves power generating efficiencies...



Triple Lane tube layout, another design feature, provides 3 pathways for steam travel, utilizes maximum cooling surface and produces higher condenser vacuums for power generating stations.

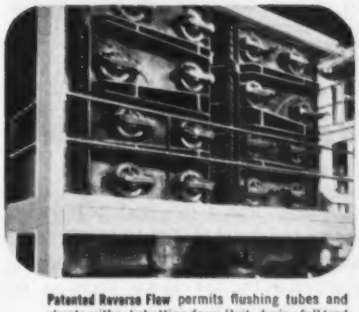


Location of air-vapor takeoff speeds steam travel and allows steam to penetrate to the peripheries of all tubes. It thus improves condenser efficiencies and overall power station operation as well.



Deaeration of condensate not to exceed 0.01 cc. oxygen/liter is available with special Wheeler designs. Note the Deaerating Bars (1), the Air-Vapor Suction Line (2), and Tubejet® Ejectors (3).

and reduces maintenance



Patented Reverse Flow permits flushing tubes and sheets without shutting down Unit, during full load with either or both circulating pumps operating. No additional circulating water inlet or discharge piping necessary with C.H. Wheeler's Reverse Flow.

"Pull-Out" Condensate Pumps simplify maintenance because entire pumping element, including all rotating parts, can be removed without disturbing either the pump barrel or the piping connections.

C. H. Wheeler Circulating Pumps, like Condensate Pumps, are easy to inspect and maintain because of "Pull-Out" design. In addition, shafts are heat treated alloy steel and impellers are statically and dynamically balanced for trouble-free operation.

C. H. Wheeler has been designing and building condensers since 1903; has developed such features as Dual Bank Design and Reverse Flow.

C. H. WHEELER MFG. CO.

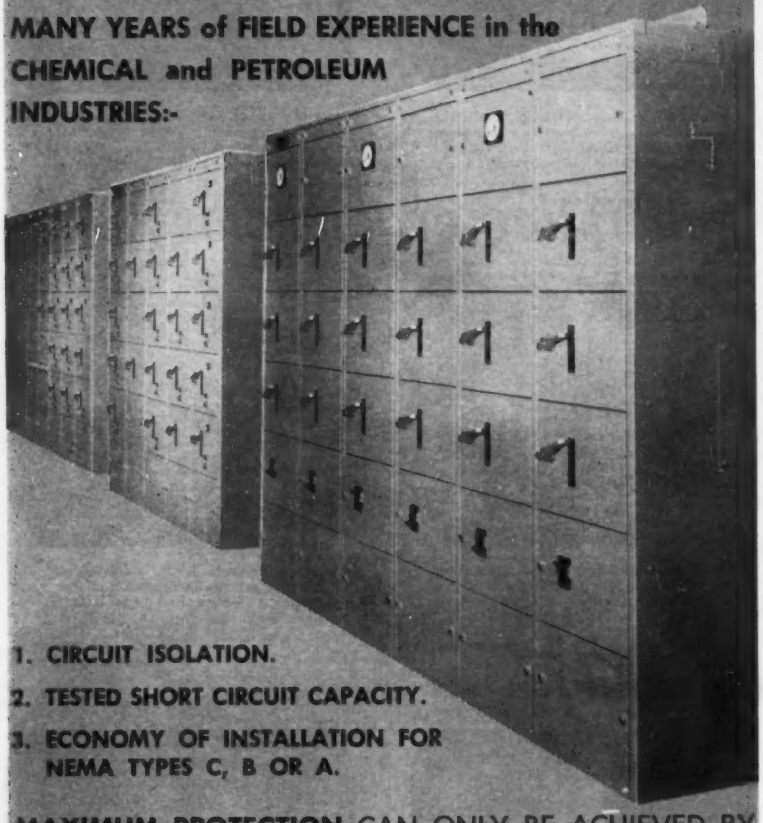
19TH & LEHIGH AVENUE
Philadelphia 32, Pennsylvania

Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products

HERE *is the* ENGINEER'S CONTROL CENTER

WITH POSITIVE FEATURES THAT WERE DEVELOPED and DESIGNED INTO THIS ALL-NEW MAXIMUM PROTECTION CONTROL CENTER as the RESULT of MANY YEARS of FIELD EXPERIENCE in the CHEMICAL and PETROLEUM INDUSTRIES:-



1. CIRCUIT ISOLATION.
2. TESTED SHORT CIRCUIT CAPACITY.
3. ECONOMY OF INSTALLATION FOR NEMA TYPES C, B OR A.

MAXIMUM PROTECTION CAN ONLY BE ACHIEVED BY COMPLETE **CIRCUIT ISOLATION** PLUS TESTED SHORT CIRCUIT CAPACITY.

SEND TODAY for your copy of the new TECHNICAL DESIGN DATA BOOK of maximum protection control centers.

NORTHEASTERN ENGINEERING, INC.
MANCHESTER, N. H. • 25 So. Bedford St.
P. O. Box 150 • NAtional 2-6485

Ohio Edison Customer Wins Housepower Contest

The $5,000 top prize in the 1958 HOUSEPOWER contest was won by Sidney Nusbaum II of Youngstown, Ohio. There were more than 300,000 entries in the contest, the second to be conducted by the Program. Contestants were asked to write a caption for a cartoon which appeared in ads in national consumer magazines.

Edison Electric Institute provided funds for the administration of the contest, as well as the $10,000 in cash prizes. Electrical manufacturers contributed electric appliance prizes valued at $90,000.

Second prize went to Charles E. Kaempen, Seal Beach, Calif.; third prize to James Doliver, Ithaca, N. Y.; and James W. Stratton, Detroit, Mich. won fourth prize.

Selling Course Presented by Calif. Appliance Bureau

"Selling Against Resistance," a sales training course presented by the Bureau of Home Appliances of San Diego County (Calif.) was held last month. The course, developed by Dan Turner, sales training director, was free to all members of the Bureau, which is sponsored by San Diego Gas & Electric Co.

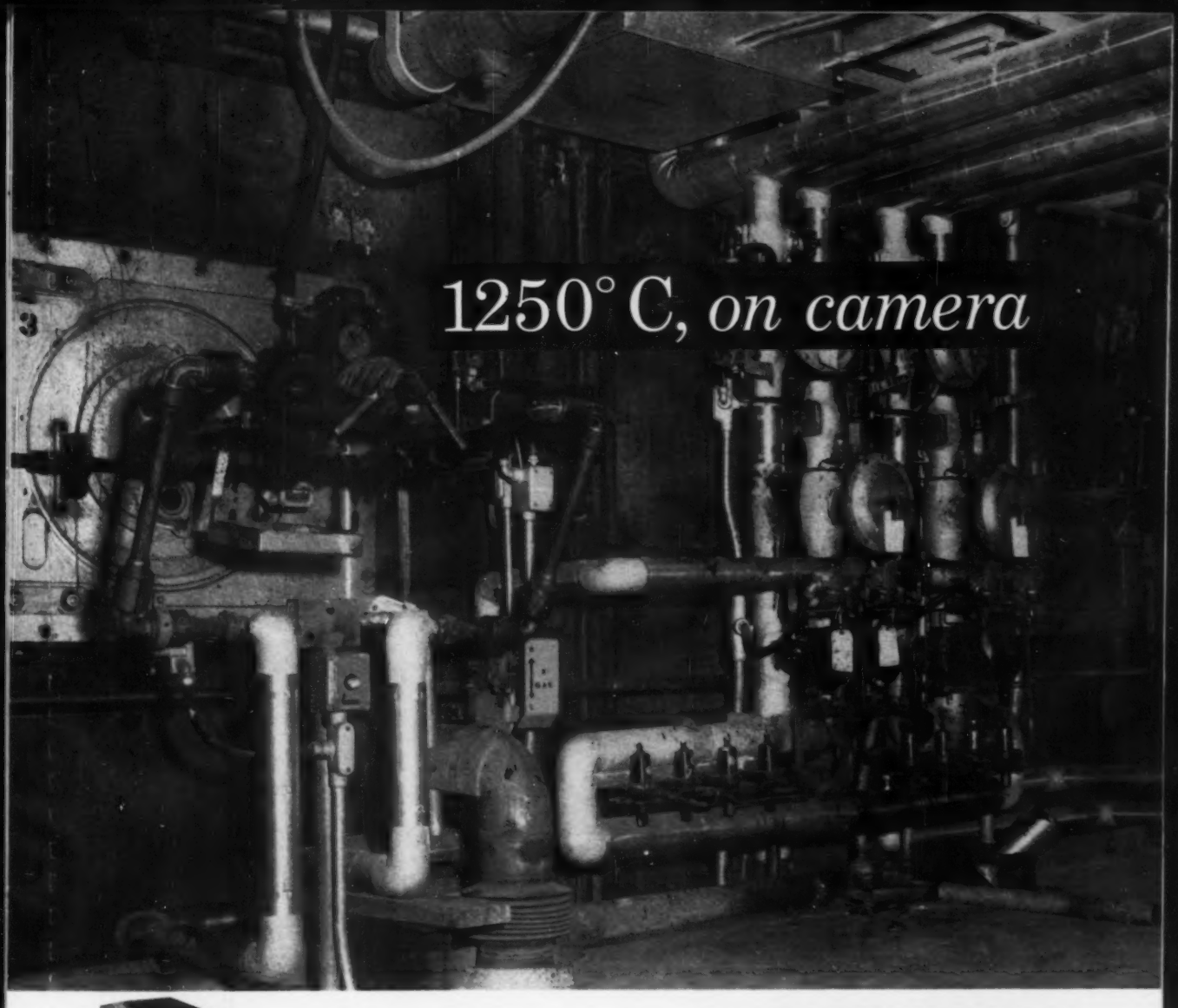
Some of the subjects covered included: How to overcome objections unobjectionably; how to have your selling points penetrate; how to outsell competition; how to tell your story; and how to close without tricks or traps.

Westinghouse to Market Infrared Heat Lamp

A low-priced infrared heat lamp with a red bowl glass front for home, shop and farm applications will be marketed by the lamp division of Westinghouse Electric Corp.

The new lamp can be used in the home for warmth and for drying operations; in the factory for drying and baking, heating metals, etc.; and on the farm purposes include: Heat for pig, lamb and poultry brooders and feeders.

The 250-w lamp has a reported life of 5,000 hr.



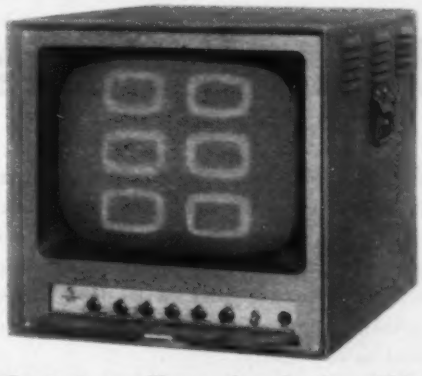
IT&T closed circuit television takes you where you've never been before... and seats you front row center.

Here is power plant visual communications in focus. And here is a fine picture assured by a 600-line resolution—the highest available in industrial television today.

IT&T manufactures a complete, quality line of closed circuit television systems at a uniformly low price, backed by a worldwide network of service specialists. The IT&T line offers such advancements as automatic light compensation as standard equipment, plus a full complement of accessories ranging from explosion-proof housings to miniature infrared viewers.

You need consider only IT&T for solutions to your visual communications problems. Write for further information, telling us the nature of your application, or call our office nearest you:

Los Angeles, Calif., EMpire 7-6161 • Detroit, Michigan, JEfferson 6-4040 • Fort Myers, Florida, WYandotte 5-2151 • Washington, D. C., EMpire 5-1515 • Denver, Colorado, AMherst 6-2714 • New York City, N. Y., OXford 5-0082 • Fort Worth, Tex., JEfferson 1-1132

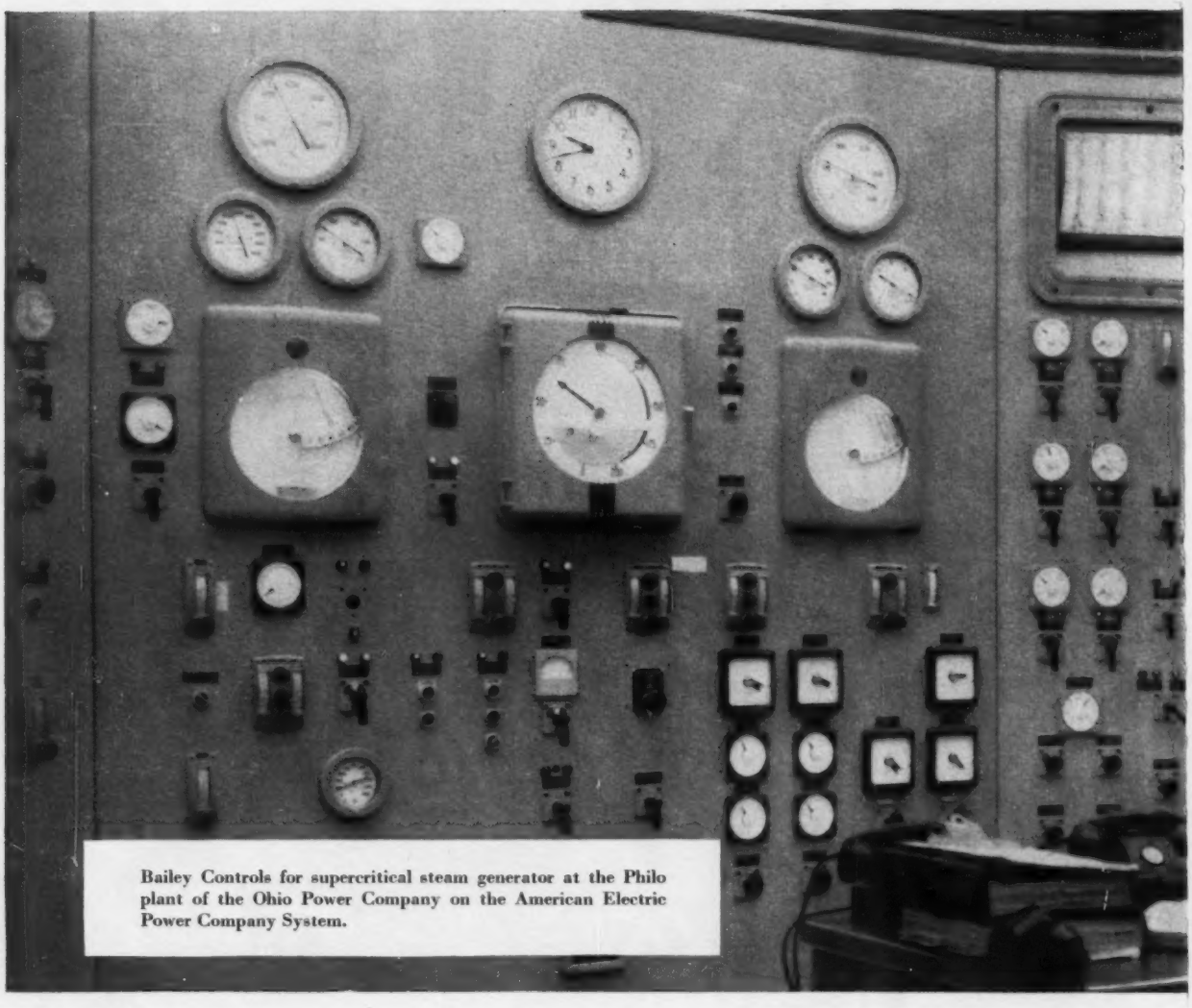


Constant surveillance of combustion within steam boilers pinpoints efficient operation. Instantaneous, single station, one operator monitoring of all gauges, instruments, smoke stacks, and other vital areas assures up-to-the-minute operating control.

INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION IT&T

Industrial Products Division

15191 Bledsoe Street, San Fernando, California, EMpire 7-6161



Bailey Controls for supercritical steam generator at the Philo plant of the Ohio Power Company on the American Electric Power Company System.

Bailey pioneers the control of...

This is the control center for the first commercial supercritical pressure, steam-electric unit in America. It went into operation March 20, 1957. Tests made during the first year of operation indicate that this new high pressure unit, with Bailey Controls, is establishing new efficiency records in the conversion of coal to electricity.

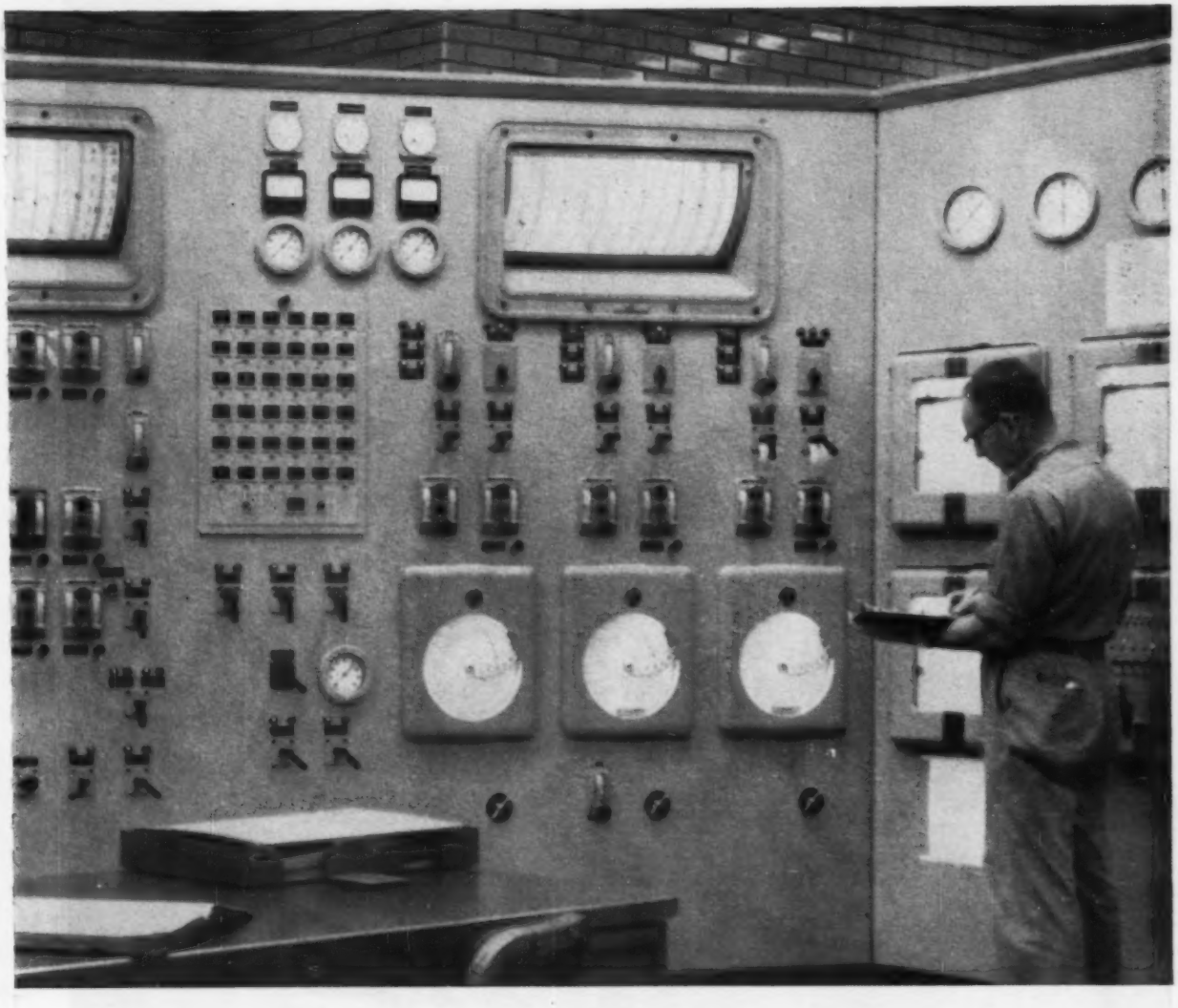
How it works

"Once-through" steam generating units must have radically different control systems from those used on drum-type boilers. At Philo, for instance, the Bailey Control for the 4500 psi, 1150F unit, maintains the desired rate of steam generation by means of a feed water flow controller which regulates feed-pump speed.

In normal operation this controller is set for a constant rate, and boiler outlet pressure is held to the desired value by automatic regulation of the turbine control valves.

An alternative operating method uses the turbine speed governor to regulate turbine control valves and varies feed water flow to maintain boiler outlet pressure.

With either method firing rate is varied to maintain final steam temperature. The Bailey System does this by regulating coal and air in parallel, primarily from changes in feed water flow with secondary adjustments, when necessary, from steam temperature.



SUPERCRITICAL STEAM PLANTS

Optimum combustion conditions are maintained by Bailey Oxygen-Combustibles Recorder-Controllers which continuously sample exit gases from each cyclone and automatically adjust coal feeder speeds.

Seasoned Engineering Experience

For greater fuel savings, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. And, for your convenience (and to save time and travel expense) there's a Bailey District Office or Resident Engineer in or close to your industrial community.

Arrange to visit a nearby Bailey installation. We stand on our record. A135-2

Instruments and controls for power and process

BAILEY METER COMPANY

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In Canada—Bailey Meter Company Limited, Montreal

HE CAN "MEASURE" MORE PROFIT FOR YOU. This Dowell service engineer can measure the amount of scale he removes from a line, using the Dowell method of chemical cleaning. *This removed scale and sludge can also be measured in increased profit dollars for your company.*

Example: Scale build-up in the main water supply line of a major Midwestern plant had reduced the "C" factor from 105 to 72. This situation became apparent just at the start of the peak season for the company. Management had a choice between laying an auxiliary line or trying to clean their present one. They decided to clean the line—but not the old-fashioned mechanical way. Time would not permit. Dowell was called in to do the job—chemically.

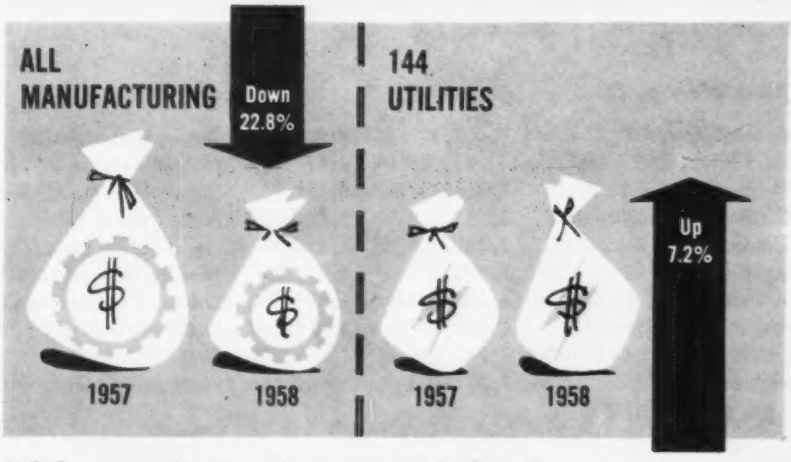
Dowell Service was fast—the job was done in three days. Dowell Service was effective—the "C" factor was increased to 92. Dowell Service was profitable for the customer—$71,000 was saved and the company's annual profit was protected.

With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus a full line of equipment, chemicals, and trained personnel. You pay one charge, get an efficient job, handled by experienced people.

Your maintenance and operating engineers probably know about Dowell Service. Ask them for the facts. Decide for yourself about the additional profit possibilities to your company with Dowell Service working for you. DOWELL—A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma, with 165 offices and stations to serve you.

Chemical cleaning service for industry DOWELL

Report on
Utility Earnings



While manufacturers' earnings declined . . .

Utility Net Rose 7.2% in Slump

Electric utility earnings continued to forge ahead in spite of the recession. During the 12 months ended June 30, 1958—a period neatly encompassing the worst of the business downturn—the net incomes of 144 electric utility companies racked up a solid 7.2% gain over the previous 12-month period. By way of contrast, the Securities & Exchange Commission reports that average net profit after taxes of all U. S. manufacturing corporations suffered a 22.8% decline during the same period.

With this show of strength in the face of adversity, the electric utility industry made a convincing bid to surpass EW's prediction of a 7% rise in net income (before all dividends) for the full calendar year 1958 (March 3, 1958, p 113).

Fastest-growing region was the South Atlantic—particularly Florida. The five investor-owned Florida utilities averaged a 19.3% gain in net income. Biggest percent increase in the nation was chalked up by little Florida Public Utilities, with a cool 66.6%. Florida Power Corp picked up 26%, while Florida Power & Light Co showed a 21% increase.

As expected, the slump hit midwestern utilities hardest. Fourteen of the 24 companies in the sample whose net incomes declined were located in the East North Central and West North Central regions.

But even in the industrial centers that bore the brunt of the recession, most utilities continued their growth. Duquesne Light Co, serving Pittsburgh, chalked up an 8.2% gain. Chicago's Commonwealth Edison Co showed a 6.7% improvement in net income. Cleveland Electric Illuminating Co gained 4.8%. Northern Indiana Public Service Co, serving the industrial region southeast of Chicago, increased net income by 2.6%. The sagging auto industry handed Detroit Edison a 2.1% decline.

Pacific Gas & Electric Co showed the largest net for the 12-month period, with $80,980,220; but the biggest dollar gain was registered by Consolidated Edison

Here Are Net Incomes for 144

COMPANY	1958	1957	COMPANY	1958	1957
Alabama Power(a)	$17,652,117	$15,959,623	Empire District Electric	$1,671,645-D	$1,806,129
Appalachian Electric (a)	18,221,549	16,619,819	Fall River Electric Light(a)	813,040	738,711
Arkansas-Missouri Power	1,268,438	1,199,964	Florida Power	10,791,921	8,548,859
Arizona Public Service	6,853,000	6,334,000	Florida Power & Light	22,241,461	18,412,210
Arkansas Power & Light(a)	8,349,580	7,695,982	Florida Public Utilities	324,535	194,746
Atlantic City Electric	5,400,679	4,845,847	Georgia Power(a)	18,594,964	16,743,863
Baltimore Gas & Electric	16,259,000-D	16,952,000	Green Mountain Power	680,168	609,809
Bangor Hydro-Electric	1,037,419-D	1,246,530	Gulf Power(a)	3,050,576	2,923,613
Blackstone Valley G & E(a)	1,715,768	1,469,163	Gulf States Utilities	11,938,948	11,750,118
Brockton Edison	1,331,792	1,084,864	Hartford Electric Light	6,979,000	6,584,000
California Electric Power	4,327,057	4,197,624	Houston Lighting & Power	19,586,128	17,825,035
California-Pacific Utilities	766,652	758,083	Idaho Power	7,470,377	5,764,814
Carolina Power & Light	12,124,666	10,800,347	Illinois Power	15,059,465	14,144,981
Central Electric & Gas	2,415,758	2,231,754	Indiana & Mich. Elec (a)	10,187,940	9,496,817
Central Hudson G & E	4,211,835	3,672,364	Indianapolis Power & Light	8,161,504	7,648,987
Central Illinois Electric & Gas	3,287,037	3,086,224	Interstate Power	3,995,663	3,137,559
Central Illinois Light	5,334,749	5,111,984	Iowa Electric Light & Power	4,334,568	4,109,802
Central Illinois Public Service	9,940,041	9,102,727	Iowa-Illinois Gas & Electric	5,482,654	5,215,034
Central Louisiana Electric	2,936,064	2,444,996	Iowa Power & Light	4,763,000-D	4,825,000
Central Maine Power	7,050,581	7,004,210	Iowa Public Service	3,950,173	3,691,742
Central Power & Light(a)	9,143,866	8,280,462	Iowa Southern Utilities	1,739,916	1,539,738
Central Vermont P S	1,464,972	1,307,633	Jersey Central P & L (a)	6,049,636	5,736,217
Cincinnati Gas & Electric	16,715,691	15,800,889	Kansas City Power & Light	10,200,049	9,600,871
Citizens Utilities	1,326,000	1,195,000	Kansas Gas & Electric	6,274,982	5,942,241
Cleveland Electric Illum.	18,592,543	17,740,090	Kansas Power & Light	6,785,279-D	7,108,419
Colorado Central Power	660,754	522,245	Kentucky Power(a)	1,336,866-D	1,370,807
Columbus & Southern Ohio	7,246,000-D	7,357,000	Kentucky Utilities	6,416,596	6,120,083
Commonwealth Edison	55,134,671	51,693,223	Lake Superior District Power	1,133,443	1,126,533
Community Public Service	1,624,479	1,531,608	Long Island Lighting	13,927,787	12,353,595
Connecticut Light & Power	12,051,040	10,565,755	Louisiana Power & Light(a)	6,654,655	5,622,771
Consolidated Edison of N. Y.	61,252,561	53,493,651	Louisville Gas & Electric	9,001,629	7,210,362
Consumers Power	32,312,119	31,811,222	Madison Gas & Electric	1,421,333-D	1,723,894
Dallas Power & Light(a)	8,588,993	7,660,225	Maine Public Service	692,821	625,775
Dayton Power & Light	10,995,000	10,303,000	Metropolitan Edison(a)	8,597,145	7,622,829
Delaware Power & Light	7,268,950	6,907,413	Michigan Gas & Electric	779,281	692,717
Detroit Edison	30,626,778-D	31,270,229	Minnesota Power & Light	4,820,445	4,458,167
Duke Power	22,035,965	19,295,776	Mississippi Power(a)	3,175,971	2,780,549
Duquesne Light	20,013,280	18,500,837	Mississippi Power & Light(a)	4,774,290	4,431,868
Edison Sault Electric	292,406	284,585	Missouri Power & Light(a)	1,514,601	1,161,562
El Paso Electric	3,168,677	2,822,902	Missouri Public Service	2,266,677	2,056,607

Operating Electric Utilities*

COMPANY	1958	1957
Missouri Utilities	$634,041-D	$650,498
Monongahela Power(a)	2,266,677	2,056,607
Montana-Dakota Utilities	3,864,743	3,584,582
Montana Power	10,678,784	10,376,734
Narragansett Electric (a)	1,383,384	1,271,111
New England G & E (b)	3,756,692	3,486,073
New Jersey P & L (a)	2,538,932	2,181,153
New Orleans P S (a)	4,795,907	4,007,054
New York State E & G	13,107,800	11,636,623
Niagara Mohawk Power	29,406,571	25,873,135
Northern Indiana P S	13,804,133	13,454,327
Northern States Pwr (Minn)	21,854,207	20,173,908
Northern States Pwr (Wisc.)	3,035,677	2,691,340
Northwestern Public Service	1,118,961	940,518
Ohio Edison	25,399,439-D	25,494,364
Oklahoma Gas & Electric	10,604,984	9,321,937
Ohio Power(a)	20,205,641	18,526,328
Otter Tail Power	1,952,712	1,934,489
Pacific Gas & Electric	80,980,220	74,977,355
Pacific Power & Light	10,842,006	9,252,632
Pennsylvania Electric(a)	15,270,571	14,179,800
Pennsylvania Power & Light	22,218,010-D	23,433,018
Philadelphia Electric	38,497,324	35,605,214
Portland General Electric	6,017,782	5,414,355
Potomac Edison(a)	5,010,550	4,586,200
Potomac Electric Power	9,965,662-D	9,982,659
Public Service of Colorado	10,153,413-D	10,807,390
Public Service Electric & Gas	34,499,439	33,498,285
Public Service of Indiana	15,526,321	14,516,269
Public Service of N.H.	4,664,245-D	4,889,693
Public Service of New Mex.	2,540,717	2,190,748
Public Service of Oklahoma	8,389,791	7,972,372
Puget Sound Power & Light	6,162,164	5,709,593
Rochester Gas & Electric	6,787,672	6,709,507
San Diego Gas & Electric	6,465,267-D	6,567,190
St. Joseph Light & Power	1,078,357-D	1,087,859
Savannah Electric & Power	1,988,948	1,513,669
Sierra Pacific Power	1,575,286	1,562,009
South Carolina E & G	7,949,029	6,126,616
Southern California Edison	36,366,503	32,302,618
Southern Indiana G & E	$2,860,020	$2,541,367
Southern Nevada Power	896,155-D	1,048,298
Southwestern Electric (a)	6,322,282	6,073,509
Southwestern Public Service	8,411,739-D	8,427,325
Tampa Electric	4,407,437	4,146,211
Texas Electric Service(a)	15,392,617	14,162,761
Texas Power & Light(a)	13,132,220	12,064,753
Toledo Edison	6,671,476	6,530,386
Tucson Gas Electric L & P.	2,781,031	2,294,279
Union Electric	19,423,000-D	22,055,000
United Illuminating	4,542,541	4,387,497
Upper Peninsula Power	548,165-D	657,740
Utah Power & Light	8,724,500	7,806,518
Virginia Electric & Power	25,760,000	22,450,000
Washington Water Power.	5,969,808	5,595,038
West Penn Power(a)	14,112,841	13,814,606
West Texas Utilities(a)	4,338,276	3,931,151
Western Light & Telephone.	1,770,175-D	1,820,036
Western Massachusetts	3,915,080	3,772,504
Wheeling Electric(a)	738,630	538,460
Wisconsin Electric Power	12,458,759-D	14,192,130
Wisconsin Michigan Power.	1,679,696-D	1,823,478
Wisconsin Power & Light	6,973,127	6,565,150
Wisconsin Public Service	5,541,297	5,479,942
Total—144 companies	**$1,389,369,093**	**$1,296,343,255**

(a)—All common shares owned by a holding company.
(b)—Holding company controlling 4 operating companies.
D —Decrease in net income.

*

For the 12 months ended June 30, 1958 and June 30, 1957

In the past, EW has reported periodically the net incomes of a sample of 90 operating electric utilities. Owing to several requests from our readers, the sample has been enlarged this year to include 144 companies.

Co of New York—$7,758,910. PG&E showed a $6 million increase. Niagara-Mohawk Power Corp, with the aid of a rate increase which went into effect late last year, bounced back from a long string of earnings declines with a $3.5-million increase in net income. The company's earnings had dropped almost $3 million since the calendar year 1955. A rate hike also helped Southern California Edison Co to recoup some earlier losses. So Cal Ed's 1957 earnings had dipped $1.7 million below 1956, but for the 12 months ended June 30, 1958, the company showed a $4-million increase in net income over the preceding 12 months.

These Ten Companies Made Largest Net-Income Gains

Company	Percent Increase
Florida Public Utilities	66.6
Wheeling Electric	37.2
Savannah Electric & Power	31.3
Missouri Power & Light	30.4
South Carolina Electric & Gas	29.7
Idaho Power	29.6
Interstate Power	27.3
Colorado Central Power	26.5
Florida Power	26.2
Louisville Gas & Electric	24.8

While These Ten Showed the Largest Declines

Company	Percent Decline
Madison Gas & Electric	17.6
Bangor Hydro-Electric	16.8
Upper Peninsula Power	16.6
Southern Nevada Power	14.5
Wisconsin Electric Power	12.2
Union Electric	11.9
Wisconsin-Michigan Power	7.9
Empire District Electric	7.4
Public Service of Colorado	6.1
Pennsylvania Power & Light	5.2

Biggest percent decline in net income afflicted Madison Gas & Electric Co, in spite of the fact that the Wisconsin utility's gross income was well above the previous 12 months. Construction expenditures dropped off after the company put a 44,000-kw unit into operation in 1957, cutting interest during construction from $336,201 to a mere $8,950. The drop in this credit was larger than Madison's decline in net. Bangor Hydro-Electric Co, whose 1957 net had dropped 14.2% below 1956, slipped to 16.8% below a year-ago levels in the 12 months ended June 30, 1958. Bangor has a $460,000-a-year rate increase petition pending before the Maine Public Utilities Commission.

Union Electric Co showed the largest dollar decline in net income, but unusual circumstances contributed heavily. Early in 1957, the company had realized more than $2.8 million in non-recurring profits (principally from the sale of coal properties). The decline in this one item on the income statement was $2.7 million, while net income dropped by a little more than $2.6 million.

Wisconsin Electric Power Co reported a net-income decline of $1.7 million, although total revenues increased over $4.3 million. Partial rate relief was granted by Wisconsin Public Service Commission, effective the first meter reading after Aug. 1. The company had requested approximately $6 million a year in rate hikes, but the commission granted only $3.8 million.

Other companies that repeated on the downside after having shown declines from calendar year 1956 to 1957 were Pennsylvania Power & Light Co, Empire District Electric Co, and Kentucky Power Co. Empire District's net income and gross revenues both continued downward despite approximately $600,000 annually in rate increases granted early this year. Kentucky Power, also the recipient of a rate hike early this year, remained below the year-ago period in net income, but made up some ground. PP&L's net fell $1.2 million below the year-ago period. Company says drop was due to storm damage and timing of expiration of certain wholesale power contracts, and looks for early improvement.

ALLIS-CHALMERS
POWER
EQUIPMENT

DIGEST

NEW low-cost 3-phase distribution regulator alters economics of regulation

A 30% reduction in the cost of three-phase regulation is announced by Allis-Chalmers with the introduction of a new regulator in several popular ratings. This unit combines reductions of 20% in weight and 33% in size with the large cost savings.

Utilities find these savings important enough to warrant restudy of present substation commitments and re-evaluation of cost factors.

This new regulator is an outgrowth of Allis-Chalmers continuing development program. The significance of this program is best measured by the remarkable record of savings to the utility industry.

In the period between 1948 and 1958 when utility equipment costs rose anywhere from 30% to 90%, Allis-Chalmers, with this new unit, has been able to hold the rise in cost of regulation in these ratings to only 7%.

Once again three-phase regulation is available for many applications for the same price as single-phase units.

Popular Ratings

The following ratings are available: 500 and 750 kva, 8660 volts; and 500, 750 and 1000 kva, 13,200 volts.

The new unit combines the outstanding features long associated with Allis-Chalmers regulators, such as: heavy duty, "Quick-Break" tap-changing mechanism; unit construction; "Feather-Touch" control; unidirectional breather; and *Vari-Amp.*

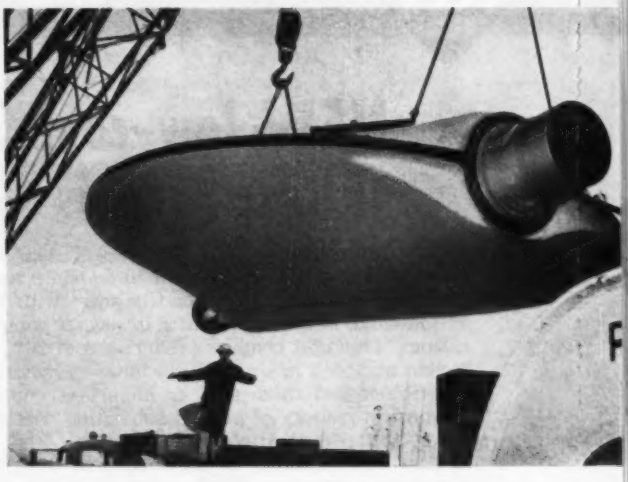
NOW...hydraulic operators for low voltage breakers from 15 to 1600 amperes

Smooth, quiet, fast-closing action is just one advantage of Allis-Chalmers hydraulic operators. This smooth action reduces stress on both operator and contact components. No adjustments are required since the closing unit is completely sealed.

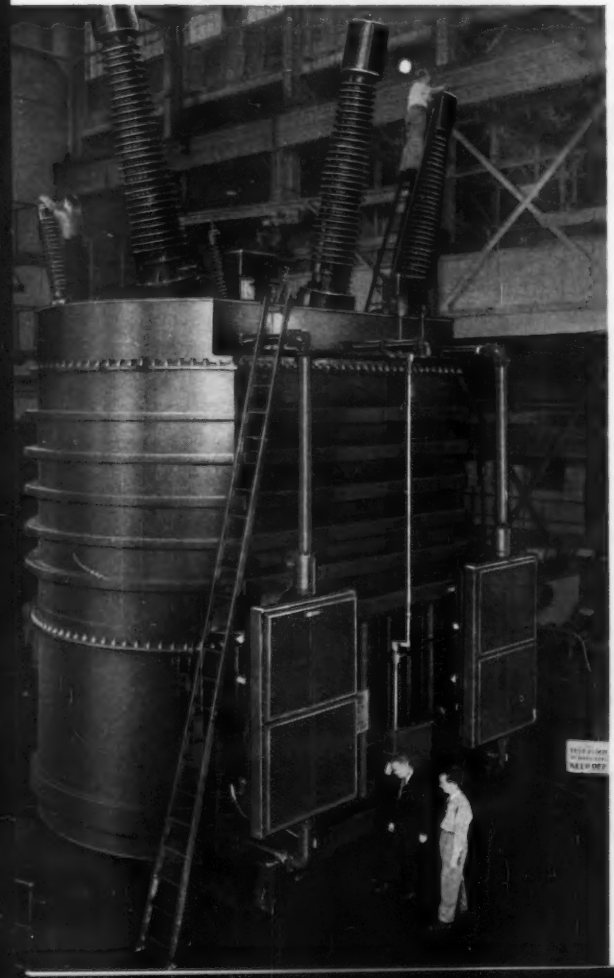
In addition, this operator unit permits closing directly from an ac power source with low control power requirements.

Valve disc and shaft

This huge 17-foot diameter, 44-ton cast steel butterfly valve disc, being lifted off truck, was built for use with a 68,000-hp, 190-ft head A-C hydraulic turbine installed in the State of Washington. Butterfly valves up to 27 feet in diameter have been built by Allis-Chalmers.



Trend seen to extra high transmission voltages



The 345-kv transformer shown here on test is another in a growing number of units in this class. Economic factors are behind this trend. At the same time as load carrying capacity of present transmission lines is beginning to be taxed—new right-of-ways are becoming more expensive and hard to get.

For some it has already become a question of either recoppering or stepping up voltage to carry the blocks of power they foresee.

A transformer for 345-kv service shown here in preparation for undergoing impulse tests on one of A-C's large impulse test floors.

ALLIS-CHALMERS

The NEW LOOK in 4.16-kv metal-clad switchgear is the low silhouette

Horizontal drawout construction, new convenience, safety and appearance are featured in recently announced Allis-Chalmers switchgear.

The new low 72-inch silhouette is the lowest in the industry and brings with it eye level instrumentation. Auxiliaries, even when placed in upper rear portion of unit, are now at shoulder height.

Complete redesign includes provision for the safest, most complete compartmentation of any switchgear. All circuits are segregated; all live parts are completely enclosed; and all metal barriers are grounded. Full interlocking further assures personnel safety.

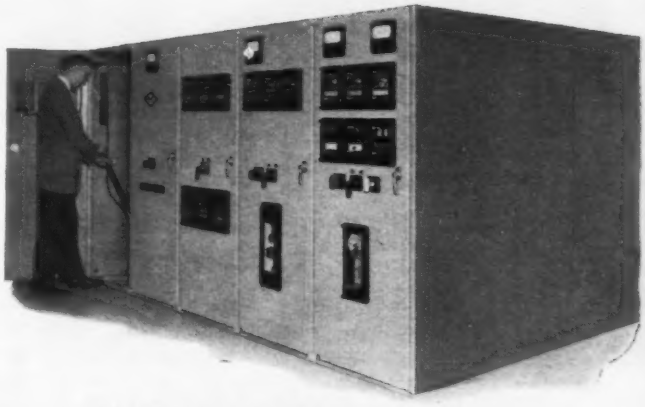
The new *Ruptair* breaker has the same design features as the larger 13.8-kv *Ruptair* breaker. Interrupting characteristics are improved to meet such needs as two-cycle operation.

A safety feature of the breaker is the hinged front metal barrier which locks firmly to the frame of the stationary structure when the breaker is in the connected position. This provides positive isolation of high voltage parts.

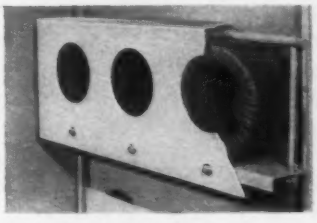
The same type mechanically trip-free four-bar linkage found on the largest Allis-Chalmers power breakers is used on *Ruptair* breakers. Quick and easy breaker disassembly is provided for contact and interrupting structure inspection.

A high level of insulation quality is maintained throughout the switchgear. All bus bar supports and primary disconnect bushings are made of high impact, high dielectric glass polyester material.

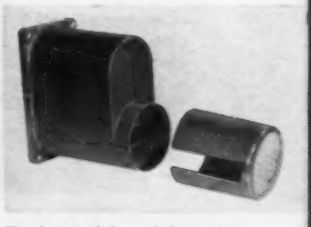
Preformed insulated joints eliminate need for molded and taped joints. This makes connecting of shipping groups at the site easier and quicker.



Man illustrates low silhouette eye level instrumentation of new switchgear.



Readily accessible toroidal-type current transformers are easy to test or change.



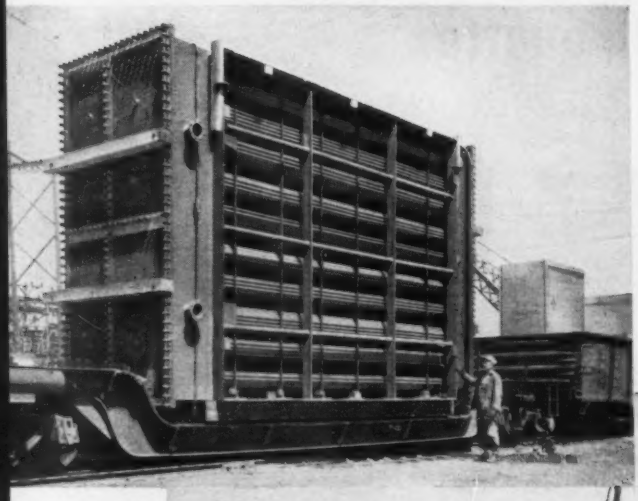
Preformed bus joint cover simplifies field connections — eliminates taping and compounds.

PROBLEM: low headroom
SOLUTION: low, low switchgear

Low ceilings frequently create problems of unusable plant space. Here is a typical example of how Allis-Chalmers makes use of "cramped" areas near load centers where standard height switchgear cannot be used.

This special 68-inch high Allis-Chalmers switchgear was designed for installation in the basement of a New England electrical manufacturing firm. Breakers shown are in the 600-volt class. Units of this design are available to other manufacturers with space problems.

Big shipping sections mean smaller condenser installation cost



Facilities for building . . . facilities for shipping have both influenced the design of Allis-Chalmers condensers. As a result units are designed in the fewest number of pieces possible for simplified installation.

Full advantage is taken of several types of special rail cars and availability of inland port facilities. In many cases, because of these shipping facilities it is possible to ship condensers of unusually large size completely tubed.

This results in simplified field assembly and helps utilities cut installation time and cost.

Literature of interest to power men

Silco-Flex system of insulation for motor coils is described in six-page bulletin. Characteristics of the insulation are detailed. Ask for **Bulletin 05B8341A.**

New 5-kv "low silhouette" metal-clad switchgear is described in 12-page bulletin. Horizontal draw-out breaker, eye level instrumentation are illustrated. Specification sheets are also available. Ask for **Bulletin 18B8965** and/or **Specification Sheets 18S7863A.**

Technical data covering new *Vari-Amp* current ratings and short-circuit ratings of Allis-Chalmers ⅝% regulators can be obtained from **Bulletin 21B9026.**

The trend to extra high voltage transformers and the background of this development are covered in a new 16-page **Bulletin 01B8771.**

Deaerator application and facts about the Allis-Chalmers line are included in **Bulletin 28B8853.**

A-5687

ALLIS-CHALMERS Milwaukee 1, Wisconsin

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Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS

McCLUNG

McKEE

MACKENZIE

Pacific P&L Makes Top Management Changes

D. R. McClung has been advanced from executive vice president to president of Pacific Power & Light Co, succeeding Paul B. McKee who becomes chairman of the board and chief executive. George Mackenzie who was vice president and treasurer, was elected vice president and comptroller. D. C. Frisbee, assistant treasurer, was made treasurer and assistant secretary.

McClung came to the company as a draftsman in the Portland office upon graduation from Benson Polytechnic in 1917. He served as a field engineer during construction of the company's hydro plant at Hood River. Other posts he has held have been those of assistant chief engineer, general superintendent, and assistant to the president.

During the Korean war, McClung spent six months in Washington, D. C., as materials and equipment division head of Defense Electric Power Administration, receiving an official commendation for his work.

McKee has been president of the company for 25 years. During this period the balance sheet assets of the company have grown from $43 million to $352 million. On two occasions he has been called upon to undertake important government assignments. The first was in 1942 when he went to Washington, D. C., to serve as special representative of Metals Reserve Co to step up development of strategic Brazilian mica and quartz crystal deposits. The other was in 1953 when he was called upon to head a survey team of American business men to study the effectiveness of the Mutual Security Administration's Point Four Program in Holland and Belgium.

Mackenzie is named comptroller, a newly created position, after serving as treasurer since 1950. He has been with the company for 41 years.

Frisbee joined the company's executive staff in 1953 as an administrative assistant to the president. He was appointed an assistant treasurer in 1956.

Georgia Power Elects Whitehead Vp

H. P. Whitehead, operating manager of the Georgia Power Co for the past four years, has been elected a vice president at a meeting of the board of directors held recently in Atlanta.

He joined the company on Nov. 1, 1929 as an equipment specialist and was successively advanced to foreman of the general repair shop, general foreman, supervisor of special construction, and assistant superintendent of the Atlanta Division.

He was transferred to Augusta in 1949 as division superintendent, remaining there until 1952 when he returned to Atlanta as general superintendent of transmission and distribution. He was appointed assistant operating manager in 1953 and operating manager of the company in 1954.

The Finest Products
Made with Aluminum
are made with
REYNOLDS ALUMINUM

Take Advantage of REYNOLDS 5005* ALUMINUM ALLOY in TRIPLEX CABLE

Reynolds low cost high strength 5005 Aluminum Alloy conductor as the bare neutral messenger makes Triplex much more attractive for service drops and secondary distribution.

The advantages of Triplex self-supporting cable over open wire installations are very well known . . . lower installation and operating costs . . . less hardware . . . neater appearance. Additional advantages are possible with Reynolds Triplex having 5005 Aluminum Alloy as the bare neutral messenger and EC aluminum as the phase conductors:

1. There is no premium price for 5005.
The cost per thousand feet for Triplex cable with a 5005 neutral is the same as that for equivalent Triplex cable with an ACSR neutral.

2. Compared with Triplex having an ACSR neutral . . .
Triplex with a 5005 neutral is easier to handle . . . simple to splice . . . dead-end devices develop full strength of the neutral. As there is no steel core wire, corrosion is minimized in contaminated atmospheres.

3. Compared with Triplex having an EC all-aluminum neutral . . .
Triplex with a 5005 neutral has higher strength . . . spans may be lengthened . . . fewer poles are required . . . greater clearances over roads, walks and buildings are possible.

Check into the savings—in materials, time, labor and maintenance—possible with Reynolds new 5005 Aluminum Alloy as the bare neutral messenger wire in Triplex Cable. Complete data on physical and electrical properties is available from Reynolds Distributors, the local Reynolds branch office, or write: *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*

*** 5005 is a new high strength all-aluminum alloy conductor developed by Reynolds. It compares with copper in sag . . . costs no more than ACSR. Write for brochure.**

REYNOLDS ALUMINUM

Watch Reynolds new TV shows—"WALT DISNEY PRESENTS" and "ALL-STAR GOLF"—every week on ABC-TV.

NEOPRENE TRIPLEX WITH 5005 ALLOY NEUTRAL COMMERCIAL SIZES

CODE WORD	EC Phase Conductors			5005 Bare Neutral Messenger				Complete Cable	
				Size					
	Size AWG	Stranding	Cover Thickness 64th"	Circular Mil	EC Equiv. Size AWG	Stranding	Ult. Str. Lbs.	Approx. Weight Lbs. per 1000 ft.	Diam. Inches
Kaki-Carp	4	7 x .0772	4	48,840	4	7 x .0835	1421	220	0.71
Kench-Shad	2	7 x .0974	4	77,640	2	7 x .1053	2196	317	0.84
Kibe-Killifish	1/0	7 x .1228	5	123,550	1/0	7 x .1328	3444	506	1.05
Kazoo-Tuna	4	7 x .0772	4	30,700	6	7 x .0662	904	203	0.71
Kaki-Shark	2	7 x .0974	4	48,840	4	7 x .0835	1421	290	0.84
Kench-Bonefish	1/0	19 x .0745	5	77,640	2	7 x .1053	2196	450	1.06

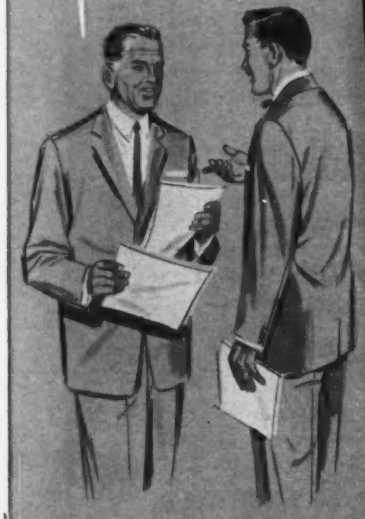
POLYETHYLENE TRIPLEX WITH 5005 ALLOY NEUTRAL COMMERCIAL SIZES

CODE WORD	EC Phase Conductors			5005 Bare Neutral Messenger				Complete Cable	
				Size					
	Size AWG	Stranding	Cover Thickness 64th"	Circular Mil	EC Equiv. Size AWG	Stranding	Ult. Str. Lbs.	Approx. Weight Lbs. per 1000 ft.	Diam. Inches
Kaki-Periwinkle	4	7 x .0772	3	48,840	4	7 x .0835	1421	165	0.65
Kench-Conch	2	7 x .0974	3	77,640	2	7 x .1053	2196	252	0.77
Kibe-Neritina	1/0	7 x .1228	4	123,550	1/0	7 x .1328	3444	412	0.99
Kazoo-Strombus	4	7 x .0772	3	30,700	6	7 x .0662	904	149	0.65
Kaki-Cockle	2	7 x .0974	3	48,840	4	7 x .0835	1421	224	0.77
Kaki-Gebia	2	7 x .0974	4	48,840	4	7 x .0835	1421	240	0.83
Kench-Janthina	1/0	7 x .1228	4	77,640	2	7 x .1053	2196	369	0.99

NOTE: These are representative sizes: for complete information on all available sizes call your nearest Reynolds office or write Reynolds Metals Co. (P.O. Box 2346-EL) Richmond 18, Virginia.

The design work on all these new substations is going to be hard to handle with our present force.

Of course! They have enough to do handling routine duties. Why don't you call in PIONEER?



GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 56 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

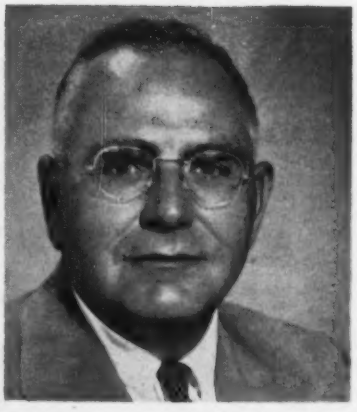
Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

56 YEARS

Pioneer Service & Engineering Co.

231 South La Salle Street
Chicago 4, Illinois



Wheeler Makes Manager

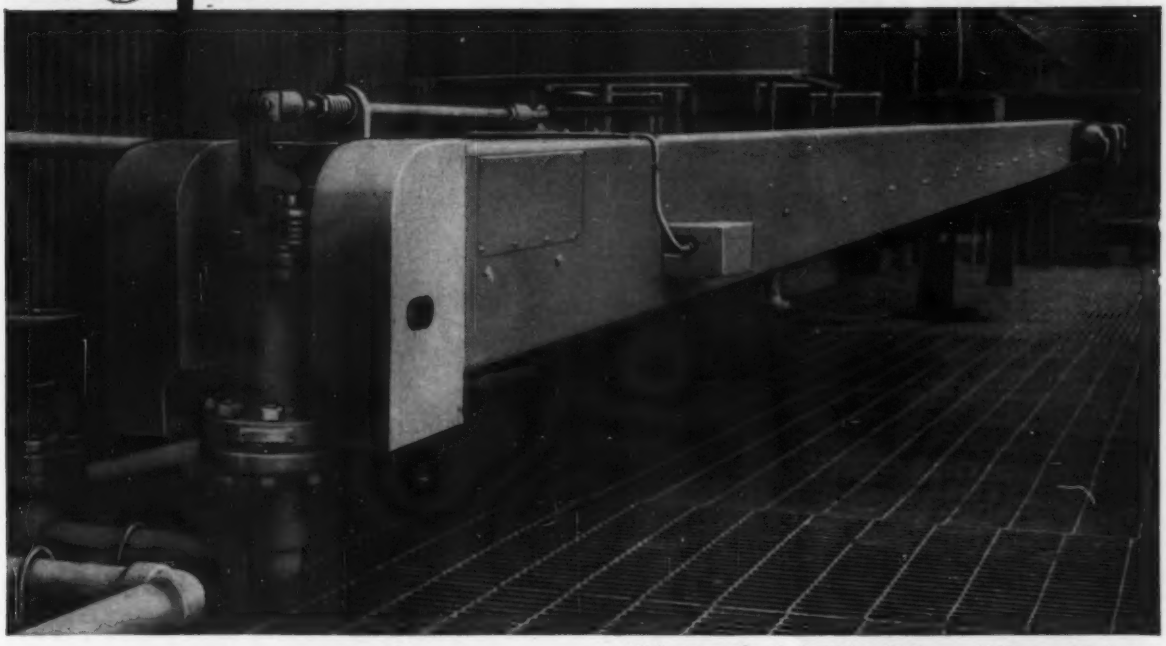
Winthrop W. Sargent has been appointed general manager of Wheeler Reflector Co, a division of Franklin Research Corp and manufacturers of lighting fixtures. He formerly filled executive posts with two Massachusetts textile firms.

Ferguson Joins A-Plant

Harry Ferguson, former vp-operations for Pennsylvania Power & Light Co, has been named general manager of the Parr Shoals, S. C., nuclear power plant now under construction by Carolinas Virginia Nuclear Power Associates. He will handle transaction details between the company members, the Atomic Energy Commision, and participating contractors.

A native of New Cumberland, W. Va., Ferguson was a PP&L vp since 1948, and previously was chief inspector of New Jersey Zinc Co. The Parr project, backed by Duke Power, Carolina Power & Light,

How Copes-Vulcan control systems boost power plant efficiency



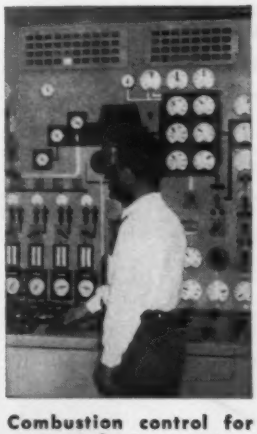
38-foot travel with this Vulcan T-30 on a 1400-psig utility boiler. Write for Reprint 1040, the story of this interesting installation.

Vulcan soot blowers clean widest furnaces ...simplify maintenance

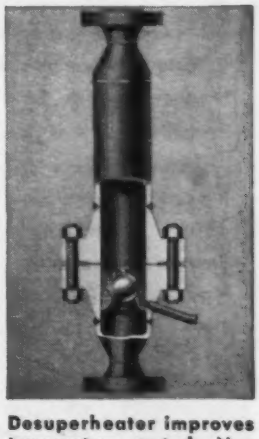
Vulcan long retractable soot blowers are products of years of experience in the utility field. A dual-motor drive permits one motor to extend and retract the lance, another to rotate it. This provides an infinite number of multi-helix jet patterns for *complete* coverage, *uniform* cleaning.

Built to withstand outdoor installations in all climates, these soot blowers feature simplicity of working parts to assure dependable operation with a minimum of outages for servicing.

One source . . . one responsibility . . . a complete service. Besides boiler cleaning equipment, Copes-Vulcan builds complete control systems for combustion, feed water, superheat and reheat temperatures, feed water bypass, pressure reducing and desuperheating. Whether furnished separately or integrated into a single package, each installation is custom-designed for the specified conditions. Write for Bulletin 1022-B.



Combustion control for every need. Copes-Vulcan combustion control adapts to all generating capacities, load ranges, pressures and fuels. Write for Bulletin 1032, the story of a utility installation featuring compact panel with miniature instruments.



Desuperheater improves temperature control. New Copes-Vulcan Variable-Orifice Desuperheater holds reduced steam temperature constant only twenty feet downstream from desuperheater outlet, even over a 50-to-1 load range. Write for Bulletin 1037.

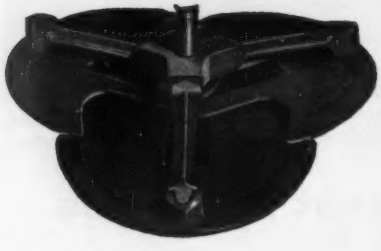
Copes-Vulcan Division
BLAW-KNOX COMPANY
Erie 4, Pennsylvania

BK-4410

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● **They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.**

Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

South Carolina Electric & Gas and Virginia Electric & Power Companies, is scheduled to go on the line in 1962.

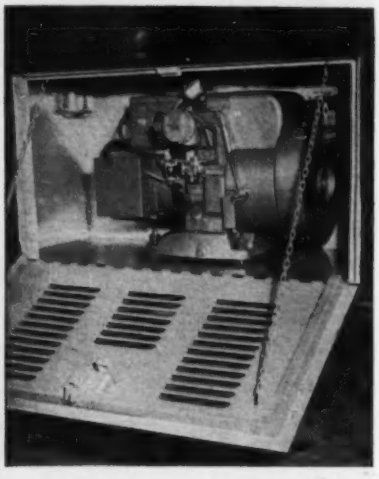
Stephens Fills Sales Post

Edward J. Stephens has been appointed general sales manager of Sequoia Wire & Cable Co. Formerly district manager for Okonite Co, he will direct sales of Sequoia products from Redwood City, Calif., headquarters. Stephens is a member of AIEE and a graduate of University of California where he majored in business administration.

PUAV Elects Stillman

The Public Utilities Association of the Virginias elected Hugh D. Stillman, Appalachian Power Co's Huntington division manager, president of the group at its 40th annual meeting. A 35-yr veteran in the industry, Stillman has served with

ELECTRIC PLANT NEWS



Charges truck batteries at far less cost... provides A.C. power, too!

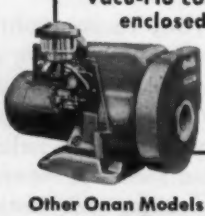
Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries for communications. Now, the 2 H.P. Onan Electric Plant does the same job . . . saving fuel and engine maintenance.

These battery charging-A.C. combination electric plants are available with 1,000 or 2,000 watts of A.C. output for operating tools and lights. Either size also delivers a full 30 amperes . . . enough to handle battery drain from radio and lighting.

Big savings reported!

One utility makes fuel savings alone estimated at $2.00 per day per truck. Another cites an annual saving of $800.00 per truck. This is based on battery charging output only. In addition, the A.C. output makes possible replacing hand tools with electric tools . . . saving time and money.

Vacu-Flo cooling permits enclosed installations



Vacu-Flo cooling is a low-cost optional feature on Onan air-cooled plants up to 10,000 watts.

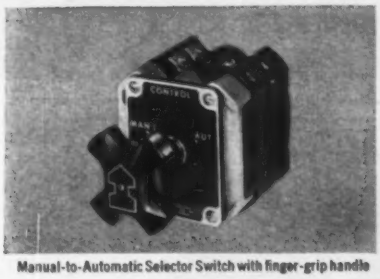
Other Onan Models 500 to 200,000 watts A.C., D.C. and Battery Charging.

Write for folder showing 3 Packaged Power Systems

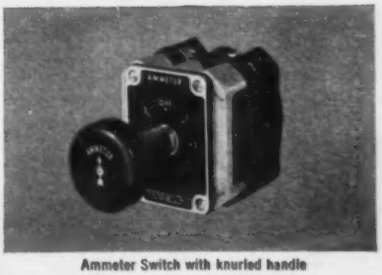
Onan
ELECTRIC PLANTS

D.W. ONAN & SONS, INC.
2838A University Ave. S.E., Minneapolis 14, Minn.

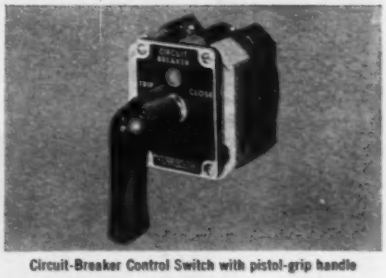
Exploded view of typical Delta-Star Type M-2 Control Switch, showing simplicity, space-saving construction, and over-all ruggedness.



Manual-to-Automatic Selector Switch with finger-grip handle



Ammeter Switch with knurled handle



Circuit-Breaker Control Switch with pistol-grip handle

Why compact DELTA-STAR Control Switches belong in your switchgear specifications

Some of the many types available

Circuit-breaker control • Manual-to-automatic selector • Voltmeter switches • Frequency meter • Synchroscope • Motor control • Ammeter switches • Power-factor meter • Regular transfer • General control • Wattmeter • Temperature meter

For all their compactness, Delta-Star Control Switches are rugged, long-lasting, and built with high interrupting capacity. Here are the features that give these switches improved efficiency, economy, and service:

Versatility—useful in many diverse ways—see examples listed at left. They're rated for 20-amp. continuous service and 250-amp. short-time (up to 3 seconds) service. Many variations of standard instrument and control switches are possible, and special arrangements are available on request.

Small Size—only 3⅞" high by 3¼" wide. Angular position of terminals makes wiring easy, even when switches are closely spaced. Large terminal clearances and complete baffling between sections. Inspection is quick and easy.

High Interrupting Capacity. At 250v ac inductive, single-break contacts have an interrupting capacity of 25 amperes, double-break contacts 75 amperes.

THESE AND OTHER FEATURES make Delta-Star Control Switches the *right* switches to specify when buying control panels and other switchgear. Call your Delta-Star representative for further details, or write *Dept. 107, Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

INDIANA STEEL & WIRE CO. MUNCIE, IND.
Crapo Galvanizing
Signs along the lines of
Crapo GALVANIZED STEEL STRAND PERFORMANCE
For dependable performance . . . insist upon Crapo Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes Crapo Steel Strand first choice for guys, messenger and overhead ground wire.
The famous Crapo galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.
• Low maintenance cost
• Laboratory tested and controlled quality
• Meets highest quality standards
• A size and grade for all practical needs
• Contact your Crapo Jobber Today!
INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

APC since 1926. As PUAV chief, he succeeds John C. Parrott, Roanoke Gas Co president.

Other PUAV officers: First vp—H. Atwood Hitch, Virigina Electric & Power Co vp; Second vp—Eric C. Summers, Monongahala Power Co executive vp; Treasurer—William F. Keehne, Appalachian Power Co assistant treasurer, who was re-elected.

PERSONAL BRIEFS

Paul L. Gunn has been named director of employee relations of Southwestern Electric Power Co at Shreveport, La.

Detroit Edison Co has announced that **E. J. Stouffer,** director of customer service, will be responsible for coordination of over-all customer service activities throughout the area served by the company. **William R. Milby,** formerly assistant director of customer services, has been appointed director of customer services for the company's Detroit Division.

Frederick P. Fairchild, chief engineer for the Public Service Electric & Gas Co, and **Vivian F. Estcourt,** general superintendent of steam generation for the Pacific Gas & Electric Co have won national awards from the American Society of Mechanical Engineers. Fairchild will receive the ASME George Washington Gold Medal for "progress in the art of designing and installing high efficiency steam generating stations and superiority in his ability to achieve prudent and consistent advances in the field." Estcourt is the recipient of the Prime Movers Committee Award for a paper, "Plant Management and Other Factors Affecting Maintenance Costs in Steam Generating Stations." Awards will be made at the ASME annual meeting to be held in New York City on Dec. 1-5.

AUTOCAR FOR THE REALLY BIG MOVING JOBS

When the heavy transport section of Ontario Hydro-Electric Power Commission was called on to move heavy-weight generators, it was another job for powerful Autocars. Here, Autocar is delivering an 80-ton transformer to the installation site—typical of the work assigned to dependable and powerful *Autocar Trucks*. When dependability counts . . . call on Autocar!

It's AUTOCAR—*for extra earning power*

Autocar Division, The White Motor Company, Exton, Pa.

Closeup of rugged LEC-TROL-FEED trolley shows its complete accessibility at section joints.

30-ton crane powered by LEC-TROL-FEED system at new U.S. Steel sintering plant, Saxonburg, Pa.

NEW U.S. STEEL PLANT INSTALLS LEC-TROL-FEED

for safe, dependable crane power supply

Two men can handle 30-foot sections of LEC-TROL-FEED system with ease.

The need for maximum safety and dependability in powering heavy cranes was met through the use of LEC-TROL-FEED for the new sintering plant of U.S. Steel Company at Saxonburg, Pa., and for other important installations.

Engineers throughout industry recognize the features that make LEC-TROL-FEED truly the finest and safest busway system on the market. A unique safety slot in bottom cover gives maximum protection from accidental contact with live bus bars. Rugged precision design assures easy installation and minimum maintenance. Specifically engineered to operate dependably despite direct accumulations, which cause trouble with ordinary busway systems.

LEC-TROL-FEED is available with bronze, aluminum, or copper bus bars, in ratings of 180, 260, and 330 amperes respectively. Standard trolley illustrated above rated 100 to 130 amperes. Higher amperages available with multiple-trolley installations. Available also for dc applications.

FREE CATALOG. Ask your nearest Delta-Star representative for the free illustrated folder which gives complete information on LEC-TROL-FEED. Or write *Dept. 137, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th and Cambria Streets, Philadelphia 32, Pa. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

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THIEL HANGERS are made according to NEMA Specifications — HEAVY STEEL construction, HOT-DIP galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts.
IN STOCK FOR IMMEDIATE DELIVERY
THIEL EASY-DRIVE
Pat. No. 2632356
FASTENERS
FOR ELECTRICIANS... REFRIGERATOR MEN PLUMBERS
STAPLES
NEW "GRIP-TYPE"
STRAPS
ANOTHER FIRST FOR THIEL
NEW HUMP
PAT. PENDING
NAIL-IT STRAPS
• Essential for Electrical Men
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SOLD ONLY THRU LEADING ELECTRICAL WHOLESALERS
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"PULL-IN"
COMPOUND
No. 100

LISTED and APPROVED by UNDERWRITERS LABORATORIES

For Rubber, Synthetic, Plastic or Lead-Covered Wires or Cables

Approved by Underwriters Laboratories for lubricating wires and cables to facilitate pulling them into conduits. Not injurious to wire or wire covers. Free of objectionable odors. White in color. Will not drip or run. Conveniently packed in pint, ½ gal., gal. and 5 gal. cans. Available through your electrical jobber.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street, Chicago 7, Illinois

MINERALLAC

Sales Assignments

COMPANY STAFFS

Air Reduction Sales Co has named Fred T. Wilson, Jr, who is assistant manager-sales of the sales office at New Orleans, as manager at that location, it was announced by H. C. Wallace, regional sales manager.

Allis-Chalmers Industries Group has appointed Frederick H. Linley, Jr, as Northeastern regional representative for power plant equipment.

REPRESENTATIVES

Malleable Iron Fittings Co, Pole Hardware Division, has named Charles A. Clancy, 3623 Risher Road, Youngstown 11, Ohio, as sales representative for Ohio, West Virginia, Kentucky and western Maryland, Pennyslvania, and Virginia.

Waterman Products Co has appointed these two engineering representatives: Paul Hayden Associates of East Point Georgia, to cover Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi; and R. L. Pflieger Co of San Carlos, Calif., to cover northern California and Nevada. These representatives will cover the complete Waterman line of Rakscopes, Pulsecopes, Panelscopes, Systemats, Pocketscopes, Rayonic Cathode Ray Tubes and Craftscope.

Automatic Switch Co has made the following appointments as representatives for Asco Solenoid Valves: Dillon Supply Co, Raleigh, N. C.; MG Electrical Equipment Co, Birmingham, Ala.; Mott Bros Co, Rockford, Ill.; Ralph B. Black, Albuquerque, N. M.

C & D Batteries, Inc, has named Power Operated Products, headed by Harvey J. Poplis, as the sales and service organization for C & D in Cincinnati, Ohio.

Phalo Plastics Corp has named Frank Lebell sales representative for Northern California, Nevada and Hawaii.

NEW WRIGHT
Type "C" Pull-A-Ways

THREE SIZES 1½, 3 and 6 Tons

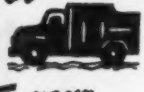
FEATURES
• Lubricated for life
• Hooks are drop-forged
• Special alloy-steel chains
• Chain sheaves of drop-forged alloy steel
• Gear teeth cut to precision limits
• Load brake is dependable and safe
• Weights:
1½-ton, 23½ lbs.
3-ton, 36½ lbs.
6-ton, 63 lbs.

ACCO

Write to York, Pa., office for complete information

Wright Hoist Division
AMERICAN CHAIN & CABLE
York, Pa., Bridgeport, Conn.

Whether a Winch Line Hook or a complete Line Body check your requirements with



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CLINTONVILLE, WISCONSIN
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manufacturer with national distribution will produce and market WORTH-WHILE patent in Electrical Field — generation, transmission, distribution, or electronics, on royalty basis. Reply in strict confidence to

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Nation Wide Mapping Services
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ELECTRICAL
MAINTENANCE
FOREMAN
At Modern, Midwestern, High Pressure, Pulverized Fuel Fired, Steam Electric, Generating Station.
35 - 55 years of age. Must be experienced in Steam-Electric Power Station Electrical Maintenance supervision. Good opportunity for man with proper qualifications.
Write stating education, experience, salary expected and availability, to:
ELECTRIC ENERGY INC.
P. O. BOX 165 JOPPA, ILL.

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CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—University graduate Engineer with at least five years experience operation steam electric generating station for responsible position in Maracaibo, Venezuela. Preference will be given Spanish speaking applicant. Salary dependent on qualifications. P-8320, Electrical World.

Electrical Engineer—Degree—Operate Utility Construction Department. Estimate, bid and supervise jobs. Good opportunity with small but growing engineering contracting firm. Location: Middle West. Send complete resume of education and experience. Include snapshot. State salary expected. P-8915, Electrical World.

Wanted—Electrical distribution construction engineer for assignment in Liberia, West Africa. Man with extensive practical experience in overhead line construction and familiar with substations, switchgear and meters, and cable work. Must be capable of training personnel. Reply in detail to P-8929, Electrical World.

EMPLOYMENT SERVICE

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Readers Forum

Oxygen at Dams

To the Editor:

I read with interest the article "Dams Affect Water Properties" (EW Aug. 11, p. 49) regarding oxygen deficiency in water discharged through turbines from high dams.

Might it not be practical, and more economical than the methods mentioned in that article, to remedy the oxygen deficiency by introducing air while the water is in motion caused by the turbines? It seems that air could be introduced in fine streams near the bottom of the exhaust raceway where the water turbulence should care for thorough mixing.

B. O. Adkerson, P.E.
420 West 119th St
New York 27, N. Y.

One-Man Responsibility

To the Editor:

The editorial, "Good Insulation Is the Utility's Responsibility" (EW, Aug. 18, p. 59) is excellent. I only wish it had been in the forefront in your June 5th and 6th meeting in New York.

When we first started in this electric heating business over eight years ago, we thought we could hire insulation for any of our electric heating installations. We soon found the reasons for failures in electric heating due to many high operating costs because of ineffective insulations and improper installations of the better materials.

Since 1952 we have been in the insulating business and consistently insulate all of our jobs to one best quality standard. This is one of the major reasons we are able to keep our operating performance under a heat factor of 120 KWH per degree day per 1,000 cu. ft. We have found that our customers uniformly desire a one-man or one-firm responsibility on the complete performance of electric heating.

Keep up the good work.

Clement L. Stanford

Electriliving Corp
4913 North College Avenue
Indianapolis, Indiana

Diameter of Conductor

To the Editor:

I note from the Sept. 8 issue of Electrical World that Mr. Howard M. Hess, Associate Dean, Wayne University, takes exception to my phraseology in defining the equivalent diameter of a stranded conductor. I am not concerned about this criticism, but am somewhat concerned about his statement "quoted from some source". (A flat statement, not an assumption.)

The definition referred to originated with the writer, based on his findings. If a definition of what constitutes the equivalent diameter of a stranded conductor has been published, prior to that appearing in the July 14, 1958, issue of Electrical World, it has not been brought to my attention.

F. C. DeWeese
Consulting Engineer
115 E. Whitaker Mill Road
Raleigh, N. C.

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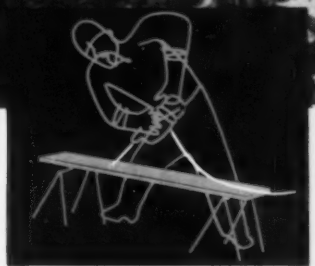

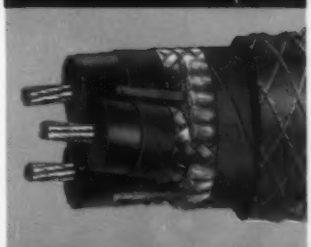

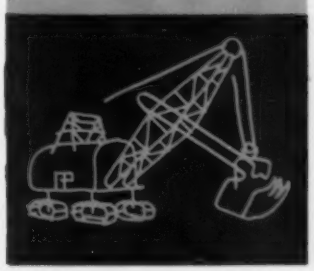

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